

Prepared in cooperation with the National Park Service

Summary Narratives to Accompany Data Series 746 Historical Rock Falls in Yosemite National Park, California (1857–2011)



Data Series 746
Summary Narratives

COVER

Photograph of the October 11, 2010, rock fall from the southeastern face of El Capitan. Photograph by Luke Lydiard, used with permission.

Summary Narratives to Accompany Data Series 746

Historical Rock Falls in Yosemite National Park, California (1857–2011)

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This document contains the summary narratives from each rock fall event listed in the data base inventory (Yosemite rock fall database 1857-2011.xlsx). The narratives highlight eyewitness reports and other written descriptions of the events, which contain many details of the rock falls not fully captured by the other data categories. Whereas all of the information provided can be found in the database itself, the narrative descriptions are included in this format for the primary purpose of improving readability, such that they can be browsed and studied as a single continuous document. In addition to the narratives, identifying information and general details are also provided, including the ID #, location, failure type, season, date and time, and relative size, in the following format:

ID Number Location information Failure type Season Date (mo/day/yr) Relative size

Explanations for these categories can be found both in the database and in the database report.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1857000001 Taft Point Profile Cliff RF n/a n/a/n/a/1857 extremely large

(1) From 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." (2) According to Park Geologist Greg Stock: Recent (2011) observations suggest that this rock fall may have occurred from the "Lost Brother" formation, which sits to the north of Profile Cliff and displays a large, rectangular, vertically-oriented, fading rock-fall scar on its north face.

1858000001 Yosemite Falls n/a RF n/a n/a/n/a/1858 extremely large

From the Mariposa Gazette (10 July 1860, p. 3): "...A fall occurred two years since from height of more than 2,000 feet, that covered at least fifty acres with stones of all sizes, great and small."

1860061101 Yosemite Falls Yosemite Falls RF Spring 6/11/1860 large

From the Mariposa Gazette (10 July 1860, p. 3): "An Indian boy was killed, June 11th, near the great Falls in Yo Semite Valley, by the falling of a large mass of rock from the high cliff, which he was near. It is somewhat dangerous early in the season, to approach the perpendicular walls which surround the Valley on account of the falling off of sometimes hundreds of tons of rock, detached and loosened by the action of frost during the winter."

1864111301 Sentinel Rock Sentinel Rock RF Fall 11/13/1864 very large

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']." [This rock fall came down the gully and drainage on the east side of Sentinel Rock.]

1868000001 Cathedral Rocks Cathedral Rocks RF n/a n/a/n/a/1868, pre very large

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."

1870070101 Half Dome Half Dome RF Summer 7/1-7/1870 medium

From the Mariposa Gazette (15 July 1870, p. 2, col. 2): "LIGHTNING IN THE YOSEMITE VALLEY- We learn that a streak of lightning struck a portion of South Dome in the Yo Semite Valley one day last week, and those who had the good fortune to see it at the moment, describe the scene as terrific as well as grand. Hundreds of tons of rock were loosened, and sliding and bounding down the side, left in its track a streak of fire, smoke and dust, and the noise therefrom sounding in the canyons like the shooting of heavy artillery."

1870080601 Glacier Point n/a RF Summer 8/6/1870 very large

From Le Conte (1875): "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."

1872032601 Union Point Eagle Rock RF Spring 3/26/1872 very large

(1) According to Galen Clark (written commun., 4 May 1872): "I have just returned from a trip to Yosemite Valley. When there I made examinations, and gained what information I could with regard to the effects of the recent earthquakes there. The debris at the base of the walls around the Valley in many places show plain indications of recent movements. In several places masses of rocks have fallen from the walls above. 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 any of the houses in the vicinity." (2) From Kneeland (1872): According to John Muir: "'Eagle Rock' had fallen from a height of 2,000 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." (3) From the Mariposa Gazette (12 April 1872): "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." (4) From Muir (1912): "In Yosemite Valley, one morning about two o'clock I was aroused by an earthquake... I feared that the sheer-fronted Sentinel Rock, which rises to a height of three thousand feet, would be shaken down, and I took shelter back of a big Pine, hoping I might be protected from outbounding boulders, should any come so far... It was a calm moonlight night, and no sound was heard for the first minute or two save a low mumbled underground rumbling and a slight rustling of the agitated trees, as if, in wrestling with the mountains, Nature were holding her breath. Then, suddenly, out of the strange silence and strange motion there came a tremendous roar. The Eagle Rock, a short distance up the valley, had given way, and I saw it falling in thousands of the great boulders I had been studying so long, pouring to the valley floor in a free curve luminous from friction, making a terribly sublime and beautiful spectacle - an arc of fire fifteen hundred feet span, as true in form and as steady as a rainbow, in the midst of the stupendous roaring rock-storm. The sound was inconceivably deep and broad and earnest... The main storm was soon over, and, eager to see the newborn talus, I ran up the valley in the moonlight and climbed 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 at the head of the talus. A cloud of dust particles, the smallest of the boulders, floated out across the whole breadth of the valley and formed a ceiling that lasted until after sunrise; and the air was loaded with the odor of crush Douglas Spruces, from a grove that had been mowed down and mashed like weeds."

1872032602 Giant Staircase Liberty Cap RF Spring 3/26/1872 very large

(1) According to Galen Clark (written commun., 4 May 1872): "The most remarkable results of the shake [26 March 1872 Owens Valley earthquake] 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 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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." (2) According to Jim Snyder (oral commun., 8 January 2004): That part of the Nevada Fall trail closest to the foot of Liberty Cap was also buried, but rerouted and repaired quickly by Snow. Parts of the old trail remain visible. (3) From Kneeland (1872): John Muir noted that "other avalanches occurred ... on the west side of the Cap of Liberty."

1872032603 Sentinel Rock Sentinel Rock RF Spring 3/26/1872 large

From Wolfe (1938): John Muir noted another rock slide triggered by the 26 March 1872 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."

1872032604 Indian Canyon Indian Canyon RF Spring 3/26/1872 large

From Kneeland (1872): John Muir noted that "other avalanches occurred in Indian and Illilouette canyons."

1872032605 Illilouette Gorge Illilouette Gorge RF Spring 3/26/1872 large

From Kneeland (1872): John Muir noted that "other avalanches occurred in Indian and Illilouette canyons."

1872032606 Union Point Eagle Rock RS Spring 3/26/1872 large

From Kneeland (1872): John Muir noted that "A second well-defined shock, about an hour after the first, was followed by another avalanche of rocks from the region of 'Eagle Rock'." [see ID 1872032601]

1873030501 Yosemite Falls Sunnyside Bench SA Winter 3/5/1873 very small

From Wolfe (1938): "Sunnyside Observations: I [John Muir] came up into my camp by the path of a snow avalanche that the trail follows through laurel groves a little to the west of Indian Canyon. I noticed some sturdy, tough live-oaks that the rock and snow avalanche had cut off. One nearly three feet in diameter had been cut sheer in two by a single stone..."

1873031201 Three Brothers Middle Brother RF Winter 3/12/1873 very large

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."

1886000001 Indian Canyon Indian Canyon RS Fall n/a/n/a/1886 large

According to the Guardian's Report 11, p. 184, 191, 223 (unpub.): Fall, 1886: In a 5 December 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."

1886032101 Merced River Gorge El Portal Road / Arch Rock RF Spring 3/21/1886 large

(1) From the Mariposa Gazette (27 March 1886, p. 3 col. 2): "A man known as Jack Allen, an old timer about Bull creek and latterly in Yosemite Valley, was killed last Sunday by the falling of towering rocks

above the Yosemite trail, between Whorton's [El Portal] and the Cascades on the Merced River. The surveying party were in the vicinity at the time and hearing the crash, Jarvis Streeter Jr. and Wade Suff went to see the cause and found Allen still alive. He had been struck by a boulder as he was walking along, and fatally injured and, lived but a short time after he was found. He was cared for as well as circumstances would admit of, and was buried in the Big Meadows on the Coulterville road below the Valley." (2) From the Mariposa Gazette (3 April 1886, p. 3, col. 4): "It was a sad day for poor Jack Allen when he fell victim to one of the remarkable freaks of nature, in the shape of a cave[-in] or a slide from a high and almost perpendicular mountain, which overhangs the trail leading up the Merced river, about three miles below the romantic spot known as the Cascade Falls. It is a lonely, uninhabited section of the river for miles either way from where the accident occurred, and the travel along the trail would scarcely average one person a day the whole year round. In the course of time, there has evidently been some very heavy landslides at this and other points along the river, where the high precipitate mountains forms a deep canyon through which the beautiful Merced river passes after leaving the Great Valley, a short distance above. It was on the 21st day of last month (March 1886), when poor Jack was plodding his way along this lonely trail leading to the Yosemite Valley, with a view, no doubt, to seeking employment during the business season. As he was passing underneath the terrible avalanche, he must have heard the noise and turned around to look back, bringing his right side toward the mountain, as the rock struck him. When examined, four ribs on the right side were broken, his right ankle was badly broken, and leg immediately below the knee crushed and right arm broken. He had evidently been hurt about an hour, when the two boys, Streeter and Duff, of the surveying party, found him, which was about noon. He was alive and could talk a little. Had it not been for the road Surveyors, Gould & Co. who were encamped at the Cascade Falls, the accident would, no doubt, have been unknown for some days afterwards. They had broken up camp that morning; Gould and two of his men had gone off on the mountain toward the Big Meadow to hunt a section corner. Streeter and Duff were to go ahead down the river to Whorton's, below, to see about some animals, leaving Frank Latchaw with the pack animals to bring up the rear. The surveying party had about completed the survey of road and were preparing to start for home. When Streeter and Duff came upon the slide from the mountain they found the trail embedded to such an extent that it was impassible for an animal, and were about starting back to inform Latchaw who was in charge of the pack train when they discovered a bundle or sack filled with something that had the appearance of clothes, belonging to some late traveler. The thought that someone might have been passing and caught in the mighty dead-fall, occurred to them when they commenced to allo; and repeated some several times, when their first presentiments were realized, by a faint response coming from among the rocks and debris some 15 or 20 yards below where the trail passed. They soon found the unfortunate man lying prostrate upon the rocks and put him in as comfortable position as they possibly could. After a short consultation with the wounded man it was decided to go back as quick as possible for other help. Allen had told the boys he could not live long, so away they went as speedily as possible to inform the other members of the surveying party of the accident. Latchaw, with his train, was intercepted and turned back as it was impracticable to get down the river owing to the condition of the trail caused by the slide. They then went on to the mountain in search of Gould and the two assistants, Coop and Gallison, who were with him, and as soon as found, they all hastened to the spot where Allen was last seen alive. Nearly five hours had elapsed since he was found by Duff and Streeter, before this party returned. Allen had, in his last agonies, struggled and got himself in an upright sitting position, in which he had died. How long he had been dead was hard to tell, it was a pity to have left him alone after being found, although no more relief could be given than was done by the boys before they left him at noon. The next thing to be done was to convey the body to some place for burial and the nearest respectable point was the Big Meadow, about six miles away. To accomplish this, two and a half miles of trail was to be gone over before reaching the Coulterville wagon road, and from thence up a steep mountain some two miles long; from thence to the spot of

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interment. This was no small task; a litter had to be cons[t]ructed out of the bushes and poles, trail being quite narrow, it fell upon two men at a time to carry the dead man until the wagon road was reached. The next morning Surveyor Gould transformed himself into an undertaker and made a rude coffin, while others dug the grave, by the side of unfortunate John Johnson, who, a short time since was found dead on the Oak Flat Road, though to have perished from cold and exhaustion. Thus concludes a chapter of the last days of poor John Henry Allen, who met with death under such peculiar circumstances. He was a native of Nova Scotia, aged 57 or 58 years, and was a pioneer of this county."

1886041701 Union Point Union Point RF Spring 4/17/1886 large

From Mariposa Gazette (24 April 1886, p.3): "Yosemite Valley, April 18th, 1886. Editor Gazette--Sir:-- After a long period of most disagreeable weather on record, it has "cleared up," and although the wind is somewhat chilling in the shaded portions of the Valley, the "orb of day" sends forth its rays of light and warmth sufficiently to create a feeling of cheerfulness [sic] for the benumbed and mud-bediggled tourist and cause him to withdraw his previously expressed opinions of the "blarsted" country and scenery, for no one with any appreciating powers for the sublime could fail to be more than satisfied with the grandeur of the surroundings. Yesterday, there appeared on the "board" something that was not down on the bills, that which for its awful magnificence is seldom witnessed by the visitor, which sent terror to the timid, and caused the stoutest heart to throb with feelings of the deepest apprehension, while some went into ecstasy [sic] over the grandeur and novelty of the occurrence. The event to which I refer was an enormous slide or fall of rock from or near "Union Point," between Cook's and Barnard's Hotels, consisting mostly of massive rocks, many of which were hurled a thousand feet or more, and out a considerable distance into the Valley, burying them deep in the soil and gravel. One, very near 20 x 30 feet, striking in a mass of smaller boulders [sic] and gravel sinking nearly its whole size and breaking in a pile resembling the works of dynamite. The effect on different individuals was varied. One man swung his hat and said he would not have missed the sight for a thousand dollars, another when told of his rare good luck in having an opportunity to witness such a novelty, replied: "O, don't say a novelty to me. I wouldn't live here for any money. Travel has been impeded by the heavy storms for the past few weeks but it is expected that a large number will arrive in a few days...."

1886041901 Sentinel Rock Sentinel Rock RS Spring 4/19/1886 medium

According to the Guardian's Report 2, p. 133 (unpub.): 19 April 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." [According to the report, Dennison saw the rock slide as an omen related to continued problems in getting McCauley to maintain the Four Mile Trail to Glacier Point.]

1886050001 Union Point Four Mile Trail RS Spring 5/n/a/1886-1905 very small

(1) According to John Degan in "Notes of Early Days in Yosemite" (written commun., 13 December 1941): "I [Degan] 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." (2) According to Jim Snyder (written commun.): "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."

1886050002 Glacier Point Four Mile Trail RS Summer 5-9/n/a/1886-1905 large

(1) According to John Degan (written commun., 13 December 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

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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." (2) According to Jim Snyder (written commun., 25 February 1992): "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."

1892050101 Glacier Point Four Mile Trail RS Spring 5/1/1892 very small

(1) According to the Guardian's Report 9, p. 40 (unpub.): "May 1, 1892: A snow slide on the Four Mile Trail at "the tramway and upper zigzags" probably brought rock down on the trail with it." (2) According to Snyder (written commun., 7 April 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."

1892121901 Giant Staircase Nevada Fall RS Fall 12/19/1892 small

According to the Guardian's Report 9, May-June 1893 (unpub.): "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."

1892121902 Yosemite Falls Yosemite Falls Trail RS Fall 12/19/1892 small

(1) According to the Guardian's Report 9, May-June 1893 (unpub.): "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." (2) According to Galen Clark in a letter to John P. Irish (written commun., 23 April 1893): "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."

1897012601 Union Point Union Point RS Winter 1/26/1897 small

According to the Guardian's Report 11, p. 49 (unpub.): "January 26, 1897: There was a rock slide on the Four Mile Trail near Union Point."

1898000001 Giant Staircase Nevada Fall RS Winter n/a/n/a/1898-99 small

According to the Guardian's Report 10, April 1899, p. 34 (unpub.): "Winter, 1899: A slide was removed from the Nevada Fall Trail. This was probably winter damage removed in April."

1900040001 Glacier Point Four Mile Trail RS Spring 4/n/a/1900 small

According to the Guardian's Report 10, April 1900, p. 393 (unpub.): "April 1900: A slide was reported on the Four Mile Trail."

1901040001 Glacier Point Four Mile Trail RS Spring 4/n/a/1901 small

According to the Guardian's Report 10, April 1901, p. 436 (unpub.): "April 1901: There was a rock slide on the Four Mile Trail."

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1901050001 Giant Staircase Mist Trail RF Spring 5/n/a/1901 very small

(1) From Foley (1901): "a rock slide across the Mist Trail was bridged by a board." (2) According to Jim Snyder (written commun., 4 November 1992): "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."

1901050002 Glacier Point Four Mile Trail RS Spring 5/n/a/1901 small

According to the Guardian's Report 10, May 1901, (unpub.): "May 1901: There was a rock slide on the Four Mile Trail ..."

1901060001 Yosemite Falls Yosemite Falls Trail RS Spring 6/n/a/1901 small

According to the Guardian's Report 10, May 1901, (unpub.): "May 1901: There was a rock slide on the Four Mile Trail and another slide on the Yosemite Falls Trail."

1907000001 Giant Staircase Nevada Fall RS Winter n/a/n/a/1907 very large

(1) According to Harry Benson, National Park Service, (written commun., 14 April 1908): "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." (2) According to Jim Snyder (written commun., 15 December 2003): "A rain on snow event on 16-26 March 1907 caused flooding on the Merced River (Clapp et al., 1908) and probably triggered this rock slide."

1909010001 Yosemite Falls Yosemite Falls Trail RS Winter 1/n/a/1909 large

(1) According to Sovulewski, National Park Service, (written commun., April 1909): January 1909: "Beginning from the foot of the upper fall for about a mile, the [Yosemite Falls] trail was practically destroyed by slides." (2) According to Young and Cruff (1967), a significant storm occurred on 13 January 1909, producing the highest water level of 1909 on the Merced River.

1909010002 Wawona Road Fort Monroe RS Winter 1/n/a/1909 medium

(1) According to Sovulewski, National Park Service, (written commun., April 1909): January, 1909: "The Wawona Road was damaged heavily to Fort Monroe." (2) According to Young and Cruff (1967), a significant storm occurred on 13 January 1909, producing the highest water level of 1909 on the Merced River.

1909010003 Rockslides Old Big Oak Flat Road RS Winter 1/n/a/1909 medium

(1) According to Sovulewski, National Park Service (written commun., April 1909): January 1909: "Rocks on the Big Oak Flat Road were blasted." (2) According to Young and Cruff (1967), a significant storm occurred on 13 January 1909, producing the highest water level of 1909 on the Merced River.

1911011601 Merced River Gorge El Portal Road RS Winter 1/16-31/1911 small

From Superintendent's Monthly Report, January 1911: "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 "

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1912000001	Hetch Hetchy	Hetch Hetchy Road	RS	Spring	n/a/n/a/1912	small
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From Hetch Hetchy Marches, 1912, p. 1 (unpub.) 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.' "

1912120001	Three Brothers	Middle Brother	RF	Fall	12/n/a/1912	medium
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From Superintendent's Monthly Report, December 1912: "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 anymore."

1913060401	Merced River Gorge	El Portal Road/Arch Rock	RS	Spring	6/4/1913	medium
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From Superintendent's Monthly Report, May 1913: "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 hundred's day's labor was expended for the immediate repairs, costing about \$250."

1913060402	Wawona Road	Fort Monroe	DS	Spring	6/4/1913	small
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From Superintendent's Monthly Report, May 1913: "The Wawona Road was repaired from the floor of the valley to Fort Monroe, a distance of 4 miles. The storm [4 June 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."

1913060403	Rockslides	Old Big Oak Flat Road	DS	Spring	6/4/1913	small
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From Superintendent's Monthly Report, May 1913: "The storm [4 June 1913] also injured this road [Wawona Road], and also the Big Oak Flat Road, but repairs were made to these two roads with only small additional help."

1913070001	Giant Staircase	Vernal Fall/Nevada Fall	RS	Spring	7/n/a/1913	small
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(1) From Superintendent's Monthly Report, July 1913: "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." [This rock slide damage may have occurred on 4 June 1913, but was repaired only in July 1913]

1913120001	Merced River Gorge	Pohono Bridge	RS	Fall	12/n/a/1913	medium
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(1) From Superintendent's Monthly Report, December 1913: "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." (2) From Road Maintenance Report from Resident Engineer for Month of January 1914 (unpub. data, 5 February 1914): "Removing slides from the El Portal Road below the Pohono Bridge. 1st, slide...This slide occurred in the month of December and was removed at total labor cost of \$83.50."

1914010001	Merced River Gorge	El Portal Road / Windy Point	RS	Winter	1/n/a/1914	large
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From the Road Maintenance Report, January 1914 (unpub.): "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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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."

1914030001 Rockslides Old Big Oak Flat Road RS Winter 1/n/a/1914 medium

From Superintendent's Monthly Report, March/April 1914: "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." [These repairs were probably from rock-slide damage from the heavy rains of January 1914 because the road was closed during the winter and repairs would not have been done right away.]

1914040001 Glacier Point Four Mile Trail RS Winter 1/n/a/1914 medium

From Superintendent's Monthly Report, April/May 1914: "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 ..." [These repairs were probably from rock-slide damage from the heavy rains of January 1914.]

1914040002 Basket Dome Snow Creek Trail RS Winter 1/n/a/1914 small

From Superintendent's Monthly Report, April/May 1914: "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." [These repairs were probably from rock-slide damage from the heavy rains of January 1914.]

1914040003 Yosemite Falls Yosemite Point DF Winter 1/n/a/1914 small

From Superintendent's Monthly Report, April/May 1914: "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." [These repairs were probably from debris-flow damage from the heavy rains of January 1914.]

1914040004 Three Brothers Eagle Peak DF Winter 1/n/a/1914 small

From Superintendent's Monthly Report, April/May 1914: "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." [These repairs were probably from debris-flow damage from the heavy rains of January 1914.]

1915000001 Giant Staircase Liberty Cap RF Winter n/a/n/a/1915-1916 large

From Mariposa Gazette (22 April 1916): "A large section of the Liberty Cap was found to have fallen during the winter storms. The slide resulted in considerable damage to the Zig-zag trail to Nevada and Vernal falls." [This rock fall came not from the 26 March 1872 Liberty Cap source area, but most likely from the same source area as the later June 1973 rock fall ID 1973060002.]

1915012701 Hetch Hetchy Hetch Hetchy Road RS Winter 1/27/1915 small

According to Charles C. Bull, National Park Service Ranger, in a letter to O.R. Prien, Chief Ranger (written commun., 27 January 1915): "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."

1917020001 Merced River Gorge El Portal Road RS Winter 2/n/a/1917 medium

From Superintendent's Monthly Report, February 1917: "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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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 ..."

1917020002 Merced River Gorge El Portal Road/Windy Point DS Winter 2-3/n/a/1917 medium

From Superintendent's Monthly Report, March 1917: "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'..." [Windy Point].

1918000001 Glacier Point Curry Village RF n/a n/a/n/a/1918? medium

(1) According to Jim Snyder (written commun., 18 December 2000): Within the area of Camp Curry, the Foster Curry cabin, built as an experimental design in 1916, was quickly rebuilt and put into use after rock fall demolished its western portion only a few years later. But it could not have been a very big rock fall that hit the west wing of the cabin, for there are no very big rocks on that side, in front of the cabin, off to one side, or underneath it that I [Snyder] could see. The cabin was built over some rocks which remain underneath the floor. It could be that some of these, 3-4 feet in diameter, were part of that rock fall. Assuming it was rocks that size reaching the bottom of the talus slope, most of the rock fall must have gotten caught farther up the talus slope behind the cabin, as is true of most smaller rock falls on talus. (2) According to Jim Snyder (written commun., 10 November 2003): "The [rock-fall source] area on the cliff for the Foster Curry Cabin talus, the small talus cone sandwiched between the Ledge Trail talus and the Terrace talus, is clearly visible, though it would be hard to say how many rock falls have come out of it over the years."

1918030001 Merced River Gorge El Portal Road RS Winter 3/n/a/1918 medium

From Superintendent's Monthly Report, March 1918: "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."

1918092701 Rockslides Old Big Oak Flat Road DS Fall 9/27 - 1/1918 medium

From Superintendent's Monthly Report, September 1918: "... 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."

1918092702 Tioga Pass Lee Vining Canyon RS Fall 9/27 - 1/1918 medium

From Superintendent's Monthly Report, September 1918: "... 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1918112801	Merced River Gorge	El Portal Road / Windy Point	RS	Fall 11/28/1918	small
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From Superintendent's Monthly Report, November 1918: "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."

1919030001	Merced River Gorge	El Portal Road	RS	Winter 3/n/a/1919	medium
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From Superintendent's Monthly Report, March 1919: "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."

1919052801	Giant Staircase	Liberty Cap	RF	Spring 5/28/1919	small
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From Superintendent's Monthly Report, May 1919: "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."

1919052802	Glacier Point	Ledge Trail	DS	Spring 5/28/1919	small
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From Superintendent's Monthly Report, May 1919: "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..."

1919052803	Glacier Point Road	Chinquapin	DF/DS	Spring 5/28/1919	small
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From Superintendent's Monthly Report, May 1919: "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..."

1919052804	Basket Dome	Snow Creek Trail	DF	Spring 5/28/1919	medium
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From Superintendent's Monthly Report, May 1919: "During the month [May 1919] ... the Tenaya Lake trail, ... suffered excessively from the storm [28 May 1919], damage having been caused in some instances that it will take weeks to repair."

1919080001	Merced River Gorge	El Portal Road/Windy Point	RS	Summer 8/n/a/1919	very large
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From Superintendent's Monthly Report, August 1919: "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."

1919081701	Taft Point	Taft Point	RS	Summer 8/17/1919	medium
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From unpub. notes of Matthes, F.E., information provided by Herbert Earl Wilson, U.S. Geological Survey Denver Field Records Library, NO-7466, folder #1, p. 33: "August 17, 1919; 6:30 p.m.- Large avalanche

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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fell from cliff at end of promontory of Taft Point. Left concave scar of great height. Consisted of thin sheet. Blocks did not roll far. Did not reach base of talus."

1920030001 Rockslides Old Big Oak Flat Road RS Winter 3/n/a/1920 small

From Superintendent's Monthly Report, March 1920: "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."

1920040001 Merced River Gorge El Portal Road/Windy Point RF Spring 4/n/a/1920 large

From Superintendent's Monthly Report, April 1920: "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".

1920092801 El Capitan El Capitan RF Fall 9/28/1920 small

From unpub. notes of Matthes, F.E., information given by Herbert Earl Wilson; U.S. Geological Survey Denver Field Records Library, NO-7466, folder #1, p.33: "September 28, 1920; 8:30 p.m.- Small avalanche from southern front of El Capitan. Origin about 1,500 feet high. Material rests on talus slope."

1921011601 Merced River Gorge El Portal Road DS Winter 1/16-30/1921 large

From Superintendent's Monthly Report, January 1921: "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 occasions. 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."

1921012801 Merced River Gorge El Portal Road DS Winter 1/28/1921 small

From Superintendent's Monthly Report, January 1921: "Storms that night [28 January 1921] brought down additional slides of earth and rock which took out part of the trestle under the new flume..."

1921091601 Three Brothers Middle Brother RF Summer 9/16/1921 small

From unpub. notes of Matthes, F.E., information given by Herbert Wilson; U.S. Geological Survey Denver Field Records Library, NO-7466, folder #1, p. 33: "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 ID 1923010301]. Made small pile of debris resting at toe of slope immediately against cliff. Dust hung in air 3 hours."

1921122401 Merced River Gorge El Portal Road RS Winter 12/24-31/1921 medium

From Superintendent's Monthly Report, December 1921: "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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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."

1922020001 Merced River Gorge El Portal Road RS Winter 2/n/a/1922 very small

From Superintendent's Monthly Report, February 1922: "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."

1922020002 Glacier Point Curry Village DS Winter 2/n/a/1922 medium

From Superintendent's Monthly Report, February 1922: "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." According to Jim Snyder, this would have been in 'Le Conte gully' in the upper part of the 1-mile 'Ledge Trail' to Glacier Point.

1922020003 Merced River Gorge El Portal Road RS Winter 2/n/a/1922 large

From Superintendent's Monthly Report, February 1922: "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."

1922030001 Merced River Gorge El Portal Road RS Winter 3/n/a/1922 medium

From Superintendent's Monthly Report, March 1922: "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."

1922072101 Glacier Point Ledge Trail RS Summer 7/21/1922 medium

From the Mariposa Gazette (29 July 1922): "Ledge trail to Glacier Pt: of 60 hikers on trail, 11 injured, one seriously, slide was caused by two days of heavy rainfall, the entire ranger force was rushed to the scene."

1923010301 Three Brothers Middle Brother RF Winter 1/3,5/1923 very large

(1) From Superintendent's Monthly Report, January 1923: "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 inches 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 be 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." (2) From unpub. notes of Matthes, F.E., information given by Herbert Wilson; U.S. Geological Survey Denver Field Records Library, NO-7466, folder #1, p. 33: "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."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Trees "blown" across roads. Shook valley like earthquake." (3) 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." (4) From unpub. report by Reynold E. Carlson (1932) "Plant succession at Rocky Point" [available at the Yosemite Research Library]: "In February [note discrepancy in date], 1923, there occurred a heavy fall of rock covering a large section of the talus slope at what is called Rocky Point in Yosemite Valley. Over a part of the area covered by the slide all plant life was either swept away or buried under rock. Over another section, where the slide was not as severe, some trees and shrubs, although badly injured, survived.... The central part of the talus did not receive as heavy a fall of rock as the eastern section, and in certain high or protected lines the original vegetation is still standing. In this section there is no doubt that the Yellow Pine was the predominating tree with only a few Golden Cup Oaks to be found in scattered places. There were also, however, a fairly large number of Douglas Firs and maples... Many trees even in this section that were twenty-four inches or even more in diameter were snapped off like toothpicks. Many of the logs still remain on the surface, and they too indicated that this was predominantly a Yellow Pine forest. ..."

1924000001 Basket Dome Snow Creek Trail RS Winter n/a/n/a/1924-1925 small

From Superintendent's Monthly Report, May 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 exact rock-fall source area is unclear.]

1924000002 Tuolumne Meadows Tioga Road DS Winter n/a/n/a/1924-1925 medium

From Superintendent's Monthly Report, June 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."

1924010001 Merced River Gorge El Portal Road/Arch Rock RS Winter 1/n/a/1924 small

From Superintendent's Monthly Report, January 1924: "A small slide occurred on this road (El Portal Road) below Arch Rock, but was taken out by the regular maintenance gang."

1924090001 Rockslides Old Big Oak Flat Road RS Summer 9/n/a/1924 medium

From Superintendent's Monthly Report, September 1924: "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]."

1924091701 Merced River Gorge El Portal Road/Windy Point RS Summer 9/17/1924 medium

From Superintendent's Monthly Report, September 1924: "On September 17th the San Joaquin Light and Power Company crew while constructing the pole line between 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."

1924110901 Basket Dome Snow Creek Trail RS Fall 11/9/1924 small

From Superintendent's Monthly Report, November 1924: "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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1924110902 Rockslides Old Big Oak Flat Road RS Fall 11/9-10/1924 small

From Superintendent's Monthly Report, November 1924: "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."

1924120001 Rockslides Old Big Oak Flat Road RS Fall 12/n/a/1924 medium

From Superintendent's Monthly Report, 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."

1925020001 Glacier Point Four Mile Trail RS Winter 2/n/a/1925 large

From Superintendent's Monthly Report, February 1925: February 1925: Damage to the Glacier Point-Four Mile 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."

1925020501 Merced River Gorge El Portal Road RS Winter 2/5/1925 small

From Superintendent's Monthly Report, January 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 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."

1925020502 Merced River Gorge El Portal Road RS/DF Winter 2/5/1925 large

From Superintendent's Monthly Report, January 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 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."

1926031501 Merced River Gorge El Portal Road/Arch Rock RS Winter 3/15-17/1926 medium

From the Mariposa Gazette (19 March 1926): "Man Badly Injured by Rock Slide: While at work on the Government highway between El Portal and Yosemite, near what is known as Arch Rock, Bill Lancey (Indian) was seriously injured when he was caught by a slide from the precipitous bluffs above the road. Lancey was quite seriously bruised and injured and was unconscious when rushed to the Government hospital at Yosemite."

1927020001 Merced River Gorge El Portal Road RS Winter 2/n/a/1927 large

From Superintendent's Monthly Report, February 1927: "... several large slides were removed from the El Portal Road."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1927100001	Merced River Gorge	El Portal Road	RS	Fall 10/n/a/1927	medium
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From Superintendent's Monthly Report, 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."

1927100002	Rockslides	Old Big Oak Flat Road	RS	Fall 10/n/a/1927	medium
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From Superintendent's Monthly Report, October 1927: "On the Big Oak Flat Road several slides occurred during the storm [heavy rainfall during the latter 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."

1928032501	Merced River Gorge	El Portal Road	RS	Spring 3/25-31/1928	small
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According to E.P. Leavitt, Acting Yosemite National Park Superintendent, in an unpublished telegram to Director National Park Service (written commun., 27 March 1928): "Heavy steady warm rain last several days melted snow bringing highest water in years doing much damage. Falling rocks broke pipeline [penstock] 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: \$1,300-penstock, \$1,500-El Portal road, \$6,000-Wawona road, \$1500-Big Oak Flat Rd, \$500-Bridalveil road, \$4,000-miscellaneous pumping plant water system."

1928040001	Rockslides	Old Big Oak Flat Road	RS	Spring 4/n/a/1928	medium
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From Superintendent's Monthly Report, 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'."

1930010001	Merced River Gorge	El Portal Road	RS	Winter 1/n/a/1930	small
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From Superintendent's Monthly Report, 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."

1930010002	Yosemite Falls	Columbia Rock	RS	Winter 1/n/a/1930	medium
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From Superintendent's Monthly Report, January 1930: "A large slide on the trail to Columbia Point was also removed."

1930020001	Merced River Gorge	El Portal Road	RS	Winter 2/n/a/1930	small
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From Superintendent's Monthly Report, February 1930: "It was necessary to remove several small rock slides from the El Portal Road..."

1930020002	Rockslides	Old Big Oak Flat Road	RS	Winter 2/n/a/1930	medium
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From Superintendent's Monthly Report, February 1930: "One large slide and a small tree were removed from the Big Oak Flat Road, making it passable from the 'El Capitan Checking Station' to 'Gentry Station'."

1930020101	Wawona Road	Wawona Road	RS	Winter 2/1/1930	medium
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(1) From Superintendent's Monthly Report, February 1930: Photograph showing "Rock slide, Wawona Road, February 1, 1930", that completely closed the road. (2) According to Jim Snyder (written commun.): "From the 1930 photograph, the amount on the road is roughly estimated to be 120 yards [110 m] 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1930030001	Wawona Road	Wawona Road/Grouse Creek	RS/DS	Winter 3/n/a/1930	small
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From Superintendent's Monthly Report, 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."

1930031701	Yosemite Falls	Columbia Rock	RS	Winter 3/17/1930	medium
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From Superintendent's Monthly Report, March 1930: "On March 17th a rock slide on the Yosemite Falls Trail wiped out one hundred feet between 'Columbia Point' and 'Valley View'."

1930031801	Yosemite Falls	Yosemite Falls	RS	Winter 3/18/1930	medium
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From Superintendent's Monthly Report, March 1930, p.11: "A series of large slides occurred on the morning of March 18th. The first slide was at 4:20 am; the second at 4:40 am and third at 5:00 am. The slides came down directly back of the old hospital." [The old hospital was north of Northside Drive near the present Yosemite Falls parking lot.]

1930031802	Yosemite Falls	Yosemite Falls	RS	Winter 3/18/1930	See ID 1930031801
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From Superintendent's Monthly Report, March 1930, p.11: "A series of large slides occurred on the morning of March 18th. The first slide was at 4:20 am; the second at 4:40 am and third at 5:00 am. The slides came down directly back of the old hospital." [The old hospital was north of Northside Drive near the present Yosemite Falls parking lot.]

1930031803	Yosemite Falls	Yosemite Falls	RS	Winter 3/18/1930	See ID 1930031801
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From Superintendent's Monthly Report, March 1930, p.11: "A series of large slides occurred on the morning of March 18th. The first slide was at 4:20 am; the second at 4:40 am and third at 5:00 am. The slides came down directly back of the old hospital." [The old hospital was north of Northside Drive near the present Yosemite Falls parking lot.]

1930070001	Rockslides	Old Big Oak Flat Road	RS	Summer 7/n/a/1930	medium
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From Superintendent's Monthly Report, 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."

1930090801	Giant Staircase	Vernal Fall	RS	Summer 9/8/1930	small
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(1) From Superintendent's Monthly Report, September 1930: "On September 8th a slide resulted in the tragic death of Mike Rhodes, a government trail laborer, near Vernal Fall." (2) According to Jim Snyder, Rhodes was likely working on the new horse trail in the cut below 'Porcupine Spring', as that is where trail work was concentrated at the time.

1930110001	Merced River Gorge	El Portal Road	RS	Fall 11/n/a/1930	small
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From Superintendent's Monthly Report, 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."

1931000001	Glacier Point	Four Mile Trail	DS	Winter n/a/n/a/1931-32	small
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From Superintendent's Monthly Report, July 1932: "Small slides were cleared from the Glacier Point or Four Mile Trail. The trail was opened for travel in May after a heavy winter. These slides, common on the Four Mile Trail below Union Point, probably occurred earlier in the winter or during spring runoff."

1931000002	Wawona Road	Turtleback Dome	RS/DS	Winter n/a/n/a/1931-32	very large
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From Superintendent's Monthly Report, March 1932: "[On the] Wawona Road, [between] Turtleback Dome [and] Big Trees ... the road has suffered considerable damage during the past winter. The slide

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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yardage on the road totals about 12,000 cubic yards and there has been considerable damage to the fills from washouts and settlement."

1931010001 Merced River Gorge El Portal Road RS Winter 1/n/a/1931 small

From Superintendent's Monthly Report, January 1931: "Several small rock slides were removed from the El Portal Road."

1931020001 Rockslides Old Big Oak Flat Road RS Winter 2/n/a/1931 small

From Superintendent's Monthly Report, 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."

1931022401 Yosemite Falls Yosemite Falls Trail RS Winter 2/24/1931 very small

From Superintendent's Monthly Report, February 1931: "A small slide occurred about the 24th on the Yosemite Falls Trail. This was cleared away."

1931060001 Rockslides Old Big Oak Flat Road RS Spring 6/n/a/1931 small

From Superintendent's Monthly Report, June 1931: "Small rock slides on the [Old] Big Oak Flat Road between the floor of the valley and 'Gentry Checking Station' required our constant attention."

1931102501 Merced River Gorge El Portal Road RS Fall 10/25/1931 medium

From Superintendent's Monthly Report, October 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."

1931122101 Merced River Gorge El Portal Road RS Winter 12/21-29/1931 medium

From Superintendent's Monthly Report, December 1931: "The month of December, 1931, can boast ... a total precipitation of 14.9 inches [37.8 cm]. 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 21 December to 29 December caused an immediate damage of \$2,000 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."

1931122102 Merced River Gorge El Portal Road RS Winter 12/21-29/1931 small

From Superintendent's Monthly Report, December 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 0.45 miles 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."

1931122103 Merced River Gorge El Portal Road RS Winter 12/21-29/1931 small

From Superintendent's Monthly Report, December 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 Man's Curve' below the dam... typical small slide 3 miles above park line."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1931122104	Merced River Gorge	El Portal Road/Arch Rock	RS	Winter	12/21-29/1931	small
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From Superintendent's Monthly Report, December 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."

1931122601	Merced River Gorge	El Portal Road/Arch Rock	RF	Winter	12/26/1931	very small
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From Superintendent's Monthly Report, December 1931, p. 13: "The first accident of its kind in park records occurred when a large boulder fell from the mountainside below Arch Rock and struck an outgoing car on the rear wheel and fender. The car was whirled completely around and faced the opposite direction. Fortunately no one was hurt but the car was towed out of the park with a smashed rear fender and wheel."

1932000001	Giant Staircase	Nevada Fall	RS	Winter	n/a/n/a/1932-33	small
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From Superintendent's Monthly Report, April 1933: "On April 6 the slide on the Nevada Fall Trail above the Mist Trail intersection had been removed."

1932000002	Giant Staircase	Vernal Fall	RS	Winter	n/a/n/a/1932-33	small
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From Superintendent's Monthly Report, April 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."

1932000003	Giant Staircase	Nevada Fall	RS	Winter	n/a/n/a/1932-33	small
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From Superintendent's Monthly Report, April 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."

1932021101	Merced River Gorge	El Portal Road/Windy Point	RS	Winter	2/11/1932	medium
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From Superintendent's Monthly Report, February 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."

1932030001	Wawona Road	Wawona Road/Grouse Creek	DSL	Winter	3/n/a/1932	medium
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(1) From Superintendent's Monthly Report, 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. (2) According to Jim Snyder (written commun., 7 April 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."

1932030002	Yosemite Falls	Yosemite Falls Trail	RS	Winter	3/n/a/1932	medium
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From Superintendent's Monthly Report, 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." [The location of 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1932040001	Giant Staircase Nevada Fall	RF	Spring	4/n/a/1932	medium
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From Superintendent's Monthly Report, 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."

1932040002	Panorama Cliff Panorama Cliff	RF	Spring	4/n/a/1932	small
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From Jensen (1933, p. 11): "... a mass [of rock] broke loose from the center of Panorama Cliff."

1932040003	Rockslides Old Big Oak Flat Road	RS	Spring	4/n/a/1932	small
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From Superintendent's Monthly Report, April 1932: Photo caption: "Large rock on Big Oak Flat Road caved in retaining wall for fifty feet. New rock wall installed this month." [The photograph looks like the lower (eastern) end of the Old Big Oak Flat Road.]

1932040004	Rockslides Old Big Oak Flat Road	RS	Spring	4/n/a/1932	very small
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From Superintendent's Monthly Report, 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 appears to have been about 6 feet in diameter.]

1932052201	Indian Canyon Lehamite Falls	RF	Spring	5/22/1932	large
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From Jensen (1933, p. 10): "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.]

1932052401	Union Point Chapel Wall	RF	Spring	5/24/1932	medium
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From Jensen (1933, p. 10): "Two days later at 4 o'clock in the morning [24 May 1932] 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."

1932052501	Indian Canyon Lehamite Falls	RF	Spring	5/25/1932	small
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From Jensen (1933, p. 10): "The next evening more [slides] were heard in Indian Canyon." [Jensen attributed these slides to freezing and thawing.]

1932052502	Glacier Point Ledge Trail	RS	Spring	5/25/1932	small
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From Jensen (1933, p. 10): 25 May 1932, evening: "Slides occurring at about the same time were reported as having fallen in the vicinity of 'Camp Curry'." According to Jim Snyder (written commun.): "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.]

1932110001	Giant Staircase Vernal Fall	RS	Fall	11/n/a/1932	very small
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From Superintendent's Monthly Report, 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."

1932122001	Yosemite Valley n/a	RS	Fall	12/20/1932	very small
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(1) From Jensen (1933, p. 10): "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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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 ..." (2) Fred Lester (U.S. Geological Survey, unpub. data, 1987) lists a M7.2 earthquake on 20 December 1932 at 22:10. PST, with an approximate epicenter location near Gabbs, Nevada, about 177 km northeast of Yosemite Valley.

1933030001 Wawona Road Wawona Tunnel RS Winter 3/n/a/1933 medium

From Superintendent's Monthly Report, 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."

1933031901 Merced River Gorge El Portal Road/Arch Rock RS Winter 3/19/1933 large

From Superintendent's Monthly Report, March 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."

1933032301 Merced River Gorge El Portal Road/Arch Rock RS Spring 3/23/1933 large

From Superintendent's Monthly Report, March 1933: "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." According to the report, it had been a heavy winter with rapid runoff during March.

1933103001 Merced River Gorge El Portal Road RS Fall 10/30-31/1933 medium

From Superintendent's Monthly Report, October 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 at various places along the road."

1934010001 Merced River Gorge El Portal Road RS Winter 1/n/a/1934 small

From Superintendent's Monthly Report, January 1934: "A few rock slides were removed from the El Portal Road early in the month."

1934112301 Rockslides Old Big Oak Flat Road RS Fall 11/23/1934 medium

From Superintendent's Monthly Report, November 1934: After 5 inches [12.7 cm] of rain between 15 and 20 November, "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."

1935010001 Merced River Gorge El Portal Road / Windy Point RS Winter 1/n/a/1935 small

From Superintendent's Monthly Report, 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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to prevent further giving away of dirt and rock which is progressively undermining an enormous boulder."

1935020001 Merced River Gorge El Portal Road RS Winter 2/n/a/1935 small

From Superintendent's Monthly Report, February 1935: "There were numerous small rocks and slides along the El Portal Road each morning after rainfalls, requiring periodic removal and patrol."

1935030001 Merced River Gorge El Portal Road RS Winter 3/n/a/1935 small

From Superintendent's Monthly Report, March 1935: "Occasional rocks and two slides were removed" from the 'All-Year Highway' [El Portal Road].

1935040001 Merced River Gorge El Portal Road RS Spring 4/n/a/1935 medium

From Superintendent's Monthly Report, April 1935: "The 11.99 inches [30.5 cm] 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."

1935040002 Wawona Road Wawona Road DS Spring 4/n/a/1935 small

(1) From Superintendent's Monthly Report, April 1935: "The 11.99 inches [30.5 cm] 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." (2) According to Jim Snyder (written commun., 7 April 1992): "This was maybe an earth slump, although rock and debris slides are more likely, or debris slides and flows."

1935041001 Yosemite Falls Yosemite Falls Trail RS Spring 4/10/1935 medium

(1) From Superintendent's Monthly Report, April 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 includes 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." (2) According to Jim Snyder (written commun.): "The slide was located on the switchback corner between 'Dorn's crossing' and the spring. The report for May 193, has a photograph of completed reconstruction through this slide."

1935052501 Merced River Gorge Big Oak Flat Road RS Spring 5/25/1935 medium

From Superintendent's Monthly Report, May 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."

1935070001 Hetch Hetchy Wapama Falls RS Summer 7/n/a/1935 very large

According to E.M. Hilton, Park Engineer in a letter to the Yosemite National Park Superintendent (written commun., 16 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."

1936000001 Glacier Point Four Mile Trail RS Winter n/a/n/a/1936-37 medium

From Superintendent's Monthly Report, May 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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 Four Mile Trail.]

1936020001 Wawona Road Wawona Road RS/DS Winter 2/n/a/1936 medium

From Superintendent's Monthly Report, February 1936: "19.53 inches [49.6 cm] of precipitation in February broke all records. There were two serious slides, and a number of smaller ones, on the Wawona Road; one of the large ones blocked traffic for about two hours."

1936020101 Yosemite Falls Yosemite Falls Trail RS Winter 2/1-7/1936 small

From Superintendent's Monthly Report, 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."

1936030001 Wawona Road Grouse Creek DS Winter 3/n/a/1936 medium

From Superintendent's Monthly Report, March, May 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.

1936040001 Merced River Gorge El Portal Road RS Spring 4/n/a/1936 small

From Superintendent's Monthly Report, 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."

1936040002 Wawona Road Grouse Creek DS Spring 4/n/a/1936 large

From Superintendent's Monthly Report, April 1936: "Slide removal on the Wawona Road, particularly at one spot, kept BPR crews busy throughout the month."

1936040003 Merced River Gorge El Portal Road DS Spring 4/n/a/1936 medium

From Superintendent's Monthly Report, 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."

1936050001 Yosemite Falls Yosemite Falls Trail RS Spring 5/n/a/1936 medium

From Superintendent's Monthly Report, 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."

1937020501 Merced River Gorge Cascades DF Winter 2/5/1937 large

From Superintendent's Monthly Report, 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."

1937020502 Wawona Road Wawona Road DS Winter 2/5/1937 small

From Superintendent's Monthly Report, February 1937: "Rain caused several smaller slides of snow and debris on the Wawona Road at about the same time [5 February 1937], closing it for a few hours."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1937021601 Merced River Gorge Big Oak Flat Road DF Winter 2/16/1937 small

(1) From Superintendent's Monthly Report, 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." (2) According to Jim Snyder (written commun., 7 April 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."

1937030001 Half Dome Medial Moraine RS Winter 3/n/a/1937 medium

(1) From Superintendent's Monthly Report, March, April 1937: 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." (2) 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." (3) 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 25-27 May 1980 Mammoth Lakes, California earthquake sequence. Presently, the rock slightly overhangs the road."

1937120901 Glacier Point LeConte Gully DF Fall 12/9-12/1937 large

(1) From National Park Service Report on Flood-Storm Damage (unpub. 1937): Photo 15: "Heavy rocky debris flow which completely blocked the road near 'Ash Can Slide'." (2) According to Jim Snyder (written commun.): "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 toboggan 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." (3) The photograph of this debris flow was published in Bertolo and Wiecezorek (2005).

1937120902 Crocker Point Washburn Slide RS Fall 12/9-12/1937 medium

From National Park Service Report on Flood-Storm Damage (unpub. 1937): Caption photo 19: "Heavy rock slide at Washburn Slide which temporarily blocked Wawona Road near Wawona Road tunnel."

1937120903 Cathedral Rocks Bridalveil Fall RS Fall 12/9-12/1937 small

From National Park Service Report on Flood-Storm Damage (unpub. 1937): Caption photo 20: "Rock slide near Bridalveil Fall on Wawona Road after high way had been reopened as one-way travel road." [The rock slide occurred at the point where the old Wawona road meets the new road near Bridalveil Fall.]

1937120904 Illilouette Gorge Illilouette Gorge DF Fall 12/9-12/1937 large

(1) From National Park Service Report on Flood-Storm Damage (unpub. 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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channels developed on the far side of the old channel, and another new channel on the near side." (2) According to Jim Snyder (written commun., 7 April 1992): "There was not much soil, but lots of rock and water involved in this event."

1937120905 Wawona Road Grapevine RS Fall 12/9-12/1937 medium

From National Park Service Report on Flood-Storm Damage (unpub. 1937): Storm Damage, 9-12 December 1937: "Slide on road near 'Grape Vine' turn ruining the base course for 120 feet, not far from Wawona."

1937121101 Merced River Gorge Big Oak Flat Road DF Fall 12/11/1937 large

From Superintendent's Monthly Report, December 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."

1937121102 Hetch Hetchy Wapama Falls RS Fall 12/11/1937 medium

From news source appended to Superintendent's Monthly Report (unpub. data, 1 August 1938): "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."

1938000001 Giant Staircase Vernal Fall RS Winter n/a/n/a/1938-39 small

From Superintendent's Monthly Report, March 1939: "Opening of trails commenced in March by removal of a number of large rocks on the Vernal Fall trail ..."

1938020001 Yosemite Valley n/a DS Winter 2/n/a/1938 medium

From Superintendent's Monthly Report, February 1938: "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." [February was a cold, stormy month with 16.64 inches of precipitation, three times normal.]

1938051401 Crocker Point Washburn Slide DSL Spring 5/14/1938 medium

From Superintendent's Monthly Report, May 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.

1938080201 Glacier Point Happy Isles RS Summer 8/2/1938 medium

(1) From Superintendent's Monthly Report, August 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.] (2) According to Carl J. Miller in a letter to Yosemite National Park Superintendent Lawrence Merriam (written commun. 16 April 1939): "In the early morning hours of 2 August 1938, there was a landslide along the nearly vertical walls ... in Yosemite National Park. The roar of the falling rock with its echoes through the valley made it sound like thunder. When daylight came the tents, trees, and cars in the east end of Yosemite Valley were observed to be covered with a fine white dust. ... It was a dust made by grinding granite against granite." (3) According to M.E. Beatty, Assistant Park Naturalist, in a letter to the Seismograph Station, University of California, Berkeley (written commun., 3 August 1938): "We are anxious to learn if your seismograph picked up an earthquake tremor at 4:30

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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a.m. August 2. We had a rather severe rock slide from Glacier Point at that time from Glacier Point and reports from residents and campers in that vicinity indicate that the slide was preceded by a tremor that knocked over a number of articles and lasted for a period of two seconds. Following this the rock slide was heard. No reports of a shock were had from people residing on the floor of Yosemite Valley which might be explained by the fact that the Valley floor is all fill material rather than solid rock. Any information you can give me will be helpful in ascertaining the cause of this rock slide." [A similar request was made by Beatty to the California Institute of Technology Seismological Laboratory on 15 August 1938] (4) According to a written commun. (17 August 1938) from Charles F. Richter in a reply letter to Beatty (written commun., 17 August 1938): "In response to your inquire of August 15, we have to report that no earthquake was registered at any of our stations at or about 4:30 a.m. August 2, and that no considerable shock has occurred in the Owens Valley or Sierra Nevada within recent months." [Similarly, the Seismograph Station at the University of California Berkeley had no record of earthquakes on 2 August 1938]

1938082801 Royal Arches Royal Arches Cascade RS Summer 8/28/1938 small

From Superintendent's Monthly Report, August 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 the source area.]

1939000001 Rockslides Old Big Oak Flat Road RS Winter n/a/n/a/1939-40 medium

From Superintendent's Monthly Report, March 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."

1939000002 Clark Range Red Peak Pass Trail RS Winter n/a/n/a/1939-40 medium

From Jim Snyder (written commun., January 1990): "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."

1940030001 Sentinel Rock Sentinel Rock RS Winter 3/n/a/1940 large

From Superintendent's Monthly Report, 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-Four Mile] trail at this location from the slide." Photographs showing the boulder and trail and phone line damage.

1941020001 Indian Canyon Church Bowl RS Winter 2/n/a/1941 small

From Superintendent's Monthly Report, February 1941: A Civilian Conservation Corps crew removed "a rock slide from the nearby bridle path"- near the Church Bowl toward Indian Canyon rather than towards the Ahwahnee Hotel.

1941020002 Wawona Road Wawona Road ESL Winter 2/n/a/1941 medium

(1) From Superintendent's Monthly Report, 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." (2) According to Jim Snyder (written commun., 7 April 1992): "Although the precise location of this slide is not known, there are several places that are likely candidates because they slump occasionally in winter or spring."

1941030001 Rockslides Old Big Oak Flat Road RS Winter 3/n/a/1941 small

From Superintendent's Monthly Report, 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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120-ton boulder on the road, destroying at least 50 lineal feet of the retaining wall of which the average height is 15 feet."

1941030002 Wawona Road Wawona Campground DS Winter 3/n/a/1941 small

From Superintendent's Monthly Report, March 1941: "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." According to the report, there was above normal rain and snowfall this winter.

1941030003 Wawona Road Rail Creek DSL Winter 3/n/a/1941 medium

From Superintendent's Monthly Report, March 1941: "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." According to the report, there was above normal rain and snowfall this winter.

1941100201 Yosemite Valley n/a RS/DS Fall 10/2/1941 medium

From Superintendent's Monthly Report, October 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."

1942040001 Indian Canyon Castle Cliffs RS Spring 4/n/a/1942 medium

From Superintendent's Monthly Report, 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."

1942042101 Merced River Gorge Big Oak Flat Road RS Spring 4/21/1942 large

From Superintendent's Monthly Report, April 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."

1943031801 Merced River Gorge Big Oak Flat Road RS Winter 3/18/1943 very large

From Superintendent's Monthly Report, March 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."

1945020201 Merced River Gorge El Portal Road/Arch Rock RS Winter 2/2/1945 medium

From Superintendent's Monthly Report, February 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."

1945050001 Rockslides Old Big Oak Flat Road RS Spring 5/n/a/1945 very large

(1) From Superintendent's Monthly Report, 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. (2) According to Jim Snyder (written commun., 7 April 1992): "This was the slide that closed the old Big Oak Flat 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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topographic map as having a break in it where the slide hit, and it is often called the 'Rockslides Trail' as a result."

1946000001 Tuolumne Meadows Little Blue Slide DS Spring n/a/n/a/1946 medium

From Superintendent's Monthly Report, June 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." [This location is a road cut, known as the "Blue Cut" or "Little Blue Slide", through glacial till with a high percentage of glacial flour. The road cut promotes slope movement when the ground is saturated.]

1946110801 Merced River Gorge Big Oak Flat Road RS Fall 11/8/1946 small

From Superintendent's Monthly Report, November 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."

1946110802 Glacier Point Road Badger Pass RS Fall 11/8/1946 small

From Superintendent's Monthly Report, November 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."

1946110803 Yosemite Falls Yosemite Falls Trail RS Fall 11/8/1946 medium

From Superintendent's Monthly Report, November 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."

1946110804 Tioga Road n/a RS Fall 11/8/1946 medium

From Superintendent's Monthly Report, November 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."

1946110805 Glacier Point Four Mile Trail RS Fall 11/8/1946 small

From Superintendent's Monthly Report, November 1946: "Work was done on the Four Mile Trail consisting of clearing the trail of slides and undergrowth and replacing or repairing water breaks."

1947000001 Yosemite Valley n/a RS Winter n/a/n/a/1947-48 medium

From Superintendent's Monthly Report, May 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."

1947020001 Merced River Gorge Big Oak Flat Road RF Winter 2/n/a/1947 very small

From Superintendent's Monthly Report, 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1947100001	Hetch Hetchy Lake Eleanor Road	RF	Fall	10/n/a/1947	medium
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From Superintendent's Monthly Report, October 1947: "A fairly large slide on the Hetch Hetchy Road approximately three miles above the dam has been removed."

1948010001	Glacier Point Road Mono Grade	RS	Winter	1/n/a/1948	large
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From Superintendent's Monthly Report, 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."

1948010002	Merced River Gorge El Portal Road	RS	Winter	1/n/a/1948	medium
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From Superintendent's Monthly Report, January 1948: "Several rock slides were also removed from the El Portal Road."

1948030001	Yosemite Valley n/a	RS	Winter	3/n/a/1948	large
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From Superintendent's Monthly Report, 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."

1948040001	Merced River Gorge Old Coulterville Road	RS	Spring	4/n/a/1948	medium
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From Superintendent's Monthly Report, 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."

1948040002	Merced River Gorge Big Oak Flat Road	RS	Spring	4/n/a/1948	large
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From Superintendent's Monthly Report, 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."

1948070201	Grizzly Peak Sierra Point Trail	RF	Summer	7/2/1948	extremely small
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(1) From Record of Lost Persons 1948-1967, unpub. (1967?): "July 2, 1948. Miss Mary E. Wilson, ..., was killed when hit by a rock on Sierra Point Trail- 2/3 way up", Yosemite National Park Archives, National Park Service Papers, Protection Division, Ranger Log Books: "Record of Lost Persons Searches Rescues 1948 to [1967]" (2) From Ghiglieri and Farabee, Jr. (2007): "Wilson [aged 75] of Los Angeles was killed by a falling rock while hiking 2/3 of the way to Sierra Point. Why this rock fell remains unknown."

1948100001	Merced River Gorge El Portal Road	RS	Fall	10/n/a/1948	small
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From Superintendent's Monthly Report, 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."

1949020001	Merced River Gorge El Portal Road	RS	Winter	2/n/a/1949	small
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From Superintendent's Monthly Report, February 1949: "Two large rocks required blasting to get them off the roads, one on the El Portal Highway..."

1949020002	Wawona Road Wawona Road	RS	Winter	2/n/a/1949	small
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From Superintendent's Monthly Report, 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1949070001 Glacier Point Ledge Trail RS Summer 7/n/a/1949 very small

From Superintendent's Monthly Report, 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."

1949072101 Glacier Point Ledge Trail RF Summer 7/21/1949 extremely small

From Jim Snyder (written commun. 27 January 2011): "On 21 July 1949, Samuel P. Nichols, 62, was hiking on the Ledge Trail below Glacier Point and was hit by a 'one foot rock' that fractured his leg. On 20 August 1949, Nichols died of heart failure in Lewis Memorial Hospital in Yosemite Valley. [Author and former Yosemite Search and Rescue Ranger] Butch Farabee found the record of Nichols' injury and death in the Ranger Log Books in the Yosemite Archives in El Portal and stated that 'The short entry would lead me to conclude the heart failure was directly related to the leg being broken a month earlier.' Though the record was not specific as to the location, the rock fall may have occurred in upper LeConte Gully from an east-facing wall there, perhaps similar to the 19 August 2004 rock fall [ID 2004081901]. The fallen rock could also have slipped out of the talus and debris in the steep gully bottom above Staircase Falls to hit Nichols on the Ledge Trail."

1949102301 Sentinel Rock Sentinel Creek RS Fall 10/23/1949 very large

(1) From McHenry (1949); reprinted as McHenry (1950): "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. Only as this cloud moved up the valley, rising almost to the top of the walls, was the magnitude of the slide revealed. 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 1,000 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. It is possible that this warmed the area sufficiently to melt any ice which might have been holding loose rock in place. Or movement might have been started by expansion of the loose rock mass, warmed by the sun. 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." (2) From Ghiglieri and Farabee, Jr. (2007): "In mere seconds at about 2 p.m. on October 23, 1949, one humongous rock slab fell from the west shoulder of Sentinel Rock. Its impact sent up a thick mushroom cloud of dust that reduced visibility to literally a few feet in the eastern end of the Valley. Half Dome vanished from view. Cars in motion abruptly slowed to a snail's pace. Drivers poked their heads out side windows and blinked away dust-stained tears while gasping for breath through handkerchiefs. Many motorists panicked, thinking that Yosemite Valley was about to be filled with rubble... The slide... closed the Four-Mile Trail. Fortunately, no one was killed."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1949102302	Sentinel Rock	Sentinel Rock	RS	Fall	10/23/1949	very large
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From McHenry (1949); reprinted as McHenry (1950): "The tremendous concussion caused by this slide (see ID 1949102301) started a second slide from the west shoulder of Sentinel Rock itself about 1,000 feet from the top. This later slide descended to within a few hundred yards of the parking area at the valley terminus of the Four Mile 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. Those trees and shrubs which were otherwise unaffected were heavily covered with a thick coating of rock dust, which would rise in a miniature cloud when the plant was shaken. 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 23 October 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."

1950010501	Merced River Gorge	Big Oak Flat Road	DS	Winter	1/5/1950	medium
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From Superintendent's Monthly Report, January 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.]

1950070001	Yosemite Falls	Yosemite Falls Trail	RS	Summer	7/n/a/1950	small
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From National Park Service Trail Report (unpub. 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."

1950111301	Yosemite Valley	n/a	DF	Fall	11/13-18/1950	medium
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From Superintendent's Monthly Report, November 1950: "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."

1950111302	Giant Staircase	Liberty Cap	RF	Fall	11/13-18/1950	very small
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(1) From Superintendent's Monthly Report, April 1948, p. 1: "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. (2) According to Jim Snyder (written commun., 7 April 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1951000001	Basket Dome	Snow Creek Trail	RS	Winter	n/a/n/a/1951-52 medium
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From National Park Service Trail Report (unpub. April 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." According to the report, 75 cubic yards of rock were removed and 35 yards blasted.

1951000002	Giant Staircase	Vernal Fall	RS	Winter	n/a/n/a/1951-52 very small
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From Superintendent's Monthly Report, April 1952: "On Vernal Fall trail up to bridge about 4 cubic yards of rock were rolled from the trail."

1951033101	Merced River Gorge	El Portal Road / Windy Point	RS	Spring	3/31/1951 large
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From Superintendent's Monthly Report, March 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 2,000 yards of material had been removed from the face of the bluff by slides and blasting."

1951040001	Merced River Gorge	El Portal Road Windy Point	RS	Spring	4/n/a/1951 medium
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From Superintendent's Monthly Report, April 1951: "The detrital material at 'Windy Point' continued throughout 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."

1951042201	Panorama Cliff	Nevada Fall	RS	Spring	4/22/1951 small
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From National Park Service Trail Report (unpub. April, 1951): "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."

1951060001	Yosemite Falls	Yosemite Falls Trail	RS	Spring	6/n/a/1951 very small
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From Jim Snyder (written commun., January 1990): "According to Jim Murphy, there was a small slide on the Yosemite Falls Trail above 'Columbia Point'."

1951082401	Little Yosemite Valley	Moraine Dome	RS	Summer	8/24/1951 small
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From National Park Service Trail Report (unpub. August 1951): "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."

1952010001	Merced River Gorge	El Portal Road / Arch Rock	RS	Winter	1/n/a/1952 small
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From Superintendent's Monthly Report, 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."

1952030001	Merced River Gorge	El Portal Road	RS	Winter	3/n/a/1952 medium
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From Superintendent's Monthly Report, 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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1952080001	Panorama Cliff Nevada Fall	RS	Summer	8/n/a/1952	small
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From National Park Service Trail Report (unpub. August 1952): "Two 3 cubic yard rocks were blasted off the Nevada Fall Horse Trail below Clark Point."

1952080002	Giant Staircase Nevada Fall	RS	Summer	8/n/a/1952	small
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From National Park Service Trail Report (unpub. 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."

1953000001	Yosemite Falls Yosemite Falls Trail	RS	Winter	n/a/n/a/1953-54	small
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From Superintendent's Monthly Report, April 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."

1953040001	Wawona Road Wawona Tunnel	RF	Spring	4/n/a/1953	medium
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From National Park Service Trail Report (unpub. August 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."

1954030001	Merced River Gorge Big Oak Flat Road	RS	Winter	3/n/a/1954	small
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From Superintendent's Monthly Report, 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."

1954062101	Panorama Cliff Nevada Fall	RS	Summer	6/21/1954	very small
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(1) From Superintendent's Monthly Report, June 1954: "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 source area above 'Porcupine Spring' and on the east side of the small gully running across the switchbacks below Clark Point. (2) From Ghiglieri and Farabee, Jr. (2007): "For the year prior to June 21, 1954, [49-year-old Charles R. Scarborough] had been working as Assistant Chief Ranger of Yosemite National Park. On this summer solstice he rode on horseback well behind Ranger Herb Ewing. The two men and their string of six mules were packing supplies to the Merced Lake Ranger Station, thirteen miles farther east. Their ride went to hell three miles up from Happy Isles, just below Clark Point. It was just after noon when, from a few hundred feet above them and sounding like a loud cannon booming, tons of granite exfoliated from a cliff. The disintegrating slab accelerated, breaking into ever-smaller chunks as it ricocheted down slope. The big pieces sheared off small oak trees as they cascaded. Ewing, leading the mules, quickly dismounted and tried to flatten himself against a rock face... Meanwhile Scarborough was positioned as sweep on the trail, ten feet behind the last mule. With a bit less advance warning than Herb Ewing got, he entered the path of the rock slide precisely at the wrong instant. The avalanche knocked him and his doomed horse off the switchback and down the brush-choked slope nearly 100 feet. When Ewing got to

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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him, it appeared that Scarborough had been killed instantly by a head injury - possibly even before falling. Amazingly the slide injured none of the other animals. Ewing himself emerged unscathed."

1954103001 Basket Dome n/a RS Fall 10/30/1954 small

(1) From Superintendent's Monthly Report, October 1954: "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." (2) According to Fred Lester, U.S. Geological Survey, unpub. data, August 1987: No earthquakes were recorded 30 October 1954 in the vicinity of Yosemite Valley, although a M 4.0 event occurred 31 October 1954 at 10:42 p.m. in the vicinity of Millerton Lake, about 40 km northeast of Fresno. (3) According to Gerald Wiczorek: The 31 October 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).

1955020201 Merced River Gorge El Portal Road RS Winter 2/2/1955 small

From Superintendent's Monthly Report, 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."

1955051501 Grizzly Peak Sierra Point Trail RF Spring 5/15/1955 very small

From Superintendent's Monthly Report, 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."

1955122301 Giant Staircase Nevada Fall DF Winter 12/23/1955 medium

(1) From Jim Snyder (written commun., January 1990): "December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches [75.6 cm]. Yosemite Valley experienced a serious flood 23 December 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..." (2) According to Jim Snyder (written commun., 7 April 1992): "This flood took out the dam at the head of Liberty Cap gully (built by Albert Snow in about 1872) 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 discernible."

1955122302 Yosemite Falls Yosemite Falls Trail RS Winter 12/23/1955 small

From National Park Service Trail Report (unpub. March 1956): On trails the flood left: "... small slides on Yosemite Falls Trail."

1955122303 Basket Dome Snow Creek Trail RS Winter 12/23/1955 small

From National Park Service Trail Report (unpub. March 1956): On trails the flood left: "... a slide on the 'Tenaya Zigzags'."

1955122304 Basket Dome Mirror Lake Trail DF Winter 12/23/1955 medium

From National Park Service Trail Report (unpub. March 1956): On trails the flood left: "... 200 cubic yards of sand on the Mirror Lake Trail."

1955122305 Glacier Point Happy Isles DF Winter 12/23/1955 small

From National Park Service Trail Report (unpub. March 1956): On trails the flood left: "... 40 cubic yards of muck and sand on the horse trail near Happy Isles."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1955122306 Yosemite Valley n/a DF Winter 12/23/1955 medium

(1) From National Park Service Trail Report (unpub. January/April 1956): On trails the flood left: "... 550 cubic yards of sand on other bridle paths" (2) According to Jim Snyder (written commun., 7 April 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."

1955122307 Yosemite Valley n/a DF Winter 12/23/1955 medium

(1) From National Park Service Trail Report (unpub. January/April 1956): On trails the flood left: "... 65 cubic yards of sand on paved walks." (2) According to Jim Snyder (written commun., 7 April 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."

1955122308 Merced River Gorge El Portal Road/Arch Rock RS Winter 12/23/1955 medium

(1) From National Park Service Trail Report (unpub. March 1956): "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." (2) According to Jim Snyder (written commun., 7 April 1992): "This slide occurred in December 1955, but it took a long time to get the report of the repair."

1955122309 Jack Main Canyon Jack Main Canyon DS Winter 12/23/1955 large

From Jim Snyder (written commun., January 1990): "December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches [75.6 cm]. Yosemite Valley experienced a serious flood 23 December 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 buried a hundred yards of trail between Paradise and Wilmer Lake."

1955122310 Tioga Road n/a RS Winter 12/23/1955 medium

(1) From Superintendent's Monthly Report, June 1956: "December was the wettest month in park records with 21 days of precipitation totaling 29.78 inches [75.6 cm]. Yosemite Valley experienced a serious flood 23 December 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." (2) According to Jim Snyder (written commun., 7 April 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."

1956011401 Merced River Gorge El Portal Road/Arch Rock RS Winter 1/14/1956 small

From Yosemite Research Library Photo Archives (unpub. 1956): "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.]

1956060001 Merced River Gorge El Portal Road/Windy Point RS Spring 6/n/a/1956 medium

From Superintendent's Monthly Report, 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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copied wall. Traffic was blocked for approximately three hours." According to the report, there was an unusually heavy snowpack that winter and unusually heavy rain that spring.

1957032401 Grizzly Peak Sierra Point Trail RF Spring 3/24/1957 very small

From Superintendent's Monthly Report, March 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."

1957080401 Glacier Point LeConte Gully RS Summer 8/4/1957 medium

From Yosemite News, 8 August 1957: "About midnight August 5 there was a loud, frightening rock slide from the cliffs in back of Camp 19 [near present-day Housekeeping Camp] which caused the occupants of some of the tents to dash outside in alarm. The only damage done was to their dignity".

1958030001 Wawona Road Wawona Road RS Winter 3/n/a/1958 medium

From Superintendent's Monthly Report, March 1958: "Due to severe storms, snow removal costs mounted to a near all time high for March. Several rock slides, including a 300 cubic yard rock slide on the Wawona Road ... occurred and were removed during the month."

1958030002 Merced River Gorge El Portal Road DS Winter 3/n/a/1958 medium

From Superintendent's Monthly Report, 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."

1958050001 Giant Staircase Nevada Fall RS Spring 5/n/a/1958 small

From Superintendent's Monthly Report, May 1958: "Three rocks which block part of the foot trail above the Silver Apron Bridge still are to be blasted."

1958120001 Union Point Union Point RF Fall 12/n/a/1958 very small

From Superintendent's Monthly Report, 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."

1960032201 Glacier Point Four Mile Trail RF Spring 3/22/1960 very small

From Superintendent's Monthly Report, March 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."

1960042301 Merced River Gorge El Portal Road RS Spring 4/23/1960 large

From Superintendent's Monthly Report, April 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."

1961000001 Hetch Hetchy Wapama Falls RS Spring n/a/n/a/1961 small

From Jim Snyder (written commun., January 1990): "According to Jim Murphy, a slide was cleared from the trail on the west side of the crossing of Wapama Falls at Hetch Hetchy."

1962111701 Three Brothers Middle Brother RS Fall 11/17/1962 small

From Superintendent's Monthly Report, November 1962: "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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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."

1963000001 May Lake May Lake RS Spring n/a/n/a/1963 very small

According to Jim Snyder (written commun., January 1990): "A big rock rolled out of the woods onto the May Lake Trail not far above the Tenaya-Glen Aulin junction toward May Lake."

1963000002 Jack Main Canyon Jack Main Canyon RS Spring n/a/n/a/1963 very small

According to Jim Snyder (written commun., January 1990): "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."

1963013101 Three Brothers Middle Brother RS Winter 1/31-3/1963 medium

From Superintendent's Monthly Report, January 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."

1963020001 Basket Dome Mirror Lake Trail DF Winter 2/n/a/1963 medium

From National Park Service Trail Report (unpub. February 1963): "300 cubic yards of muck and debris was removed from the trail near Mirror Lake."

1963020002 Grizzly Peak Happy Isles DF Winter 2/n/a/1963 medium

(1) From National Park Service Trail Report (unpub. February 1963): "100 cubic yards of material was removed from trail near Happy Isles." (2) According to Jim Snyder (written commun., 7 April 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 [on the western shoulder of Half Dome]. 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."

1963030001 Yosemite Falls Yosemite Falls Trail RS Winter 3/n/a/1963 small

From National Park Service Trail Report (unpub. March 1963): "On the Yosemite Falls trail, one slide of 30 cubic yards was removed near the base of upper falls."

1963030002 Giant Staircase Vernal Fall RS Winter 3/n/a/1963 small

From National Park Service Trail Report (unpub. March 1963): "Several small slides were removed from the Vernal Fall Trail."

1963040001 Merced River Gorge El Portal Road / Windy Point RF Spring 4/n/a/1963 small

From Superintendent's Monthly Report, 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."

1963041701 Merced River Gorge El Portal Road RS Spring 4/17/1963 medium

From Superintendent's Monthly Report, April 1963: "One 600-ton boulder closed the El Portal Road early on the 17th for about 10 hours..."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1963042001	Merced River Gorge	El Portal Road	RS	Spring	4/20/1963 medium
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(1) From Superintendent's Monthly Report, 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." (2) From the Mariposa Gazette (25 April 1963): "A slide, at the spot where the large boulder fell last week in El Portal, caused Highway 140 to be closed for two days, during the storm."

1963060701	Tioga Pass	Lee Vining Canyon	RS	Spring	6/7/1963 medium
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From Superintendent's Monthly Report, June 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."

1964000001	Rancheria Mountain	Piute Creek	RS	Spring	n/a/n/a/1964 very small
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According to Jim Snyder (written commun., January 1990): "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."

1965050001	Union Point	Union Point	RS	Spring	5/n/a/1965 small
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According to Jim Snyder (written commun., January 1990): "On the Four Mile Trail, in the chute below Union Point, three switchbacks were damaged by rock slide. These were the three switchbacks crossing the chute."

1965070001	Panorama Cliff	Nevada Fall	DF	Summer	7/n/a/1965 medium
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(1) According to Jim Snyder (written commun., January 1990): "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 Creek culvert." (2) According to Jim Snyder (written commun., 4 November 1992). "I [Snyder] 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."

1966000001	Glacier Point	Four Mile Trail	RS	Spring	n/a/n/a/1966 small
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According to Jim Snyder (written commun., January 1990): "According to Jim Murphy, trail crews cleared a slide from the Four Mile Trail at the creek crossing east of Sentinel Rock at its base."

1967000001	Panorama Cliff	Nevada Fall	RS	Spring	n/a/n/a/1967 small
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According to Jim Snyder (written commun., January 1990): "According to Jack Knierieman with photographs by Lee Patterson, several slab fragments slid into the 'Ice Cut' on the Nevada Fall Horse Trail and were blasted off 1 June 1967 by Bob Barr."

1967000002	Grizzly Peak	Sierra Point Trail	RS	Spring	n/a/n/a/1967 small
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According to Jim Snyder (written commun., January 1990): "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."

1967070001	Panorama Cliff	Panorama Point	RF	Summer	7-8/n/a/1967-68 large
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According to Jim Snyder (written commun., 29 April 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. Maxwell said it had to have happened between 10:30 and 11:00 a.m. that day, probably in

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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 [ID 1977000005]. This first rock fall was the smaller of the two and did leave the railing intact."

1968000001 Yosemite Falls Yosemite Falls Trail RS n/a n/a/n/a/1968 small

According to Jim Snyder (written commun., January 1990): "According to Jack Knierieman, there was a small slide on the trail in the upper fall gully on the Yosemite Falls Trail."

1970000001 Grizzly Peak Sierra Point Trail RS Winter - Spring n/a/n/a/1970 small

According to Jim Snyder (written commun., January 1990): "The Sierra Point Trail lost about 120 steps in the chute with the cables."

1970000002 Glacier Point LeConte Gully RS Winter n/a/n/a/1970-71 medium

According to Jim Snyder (written commun., February 25, 1992): "According to a report from rock climber 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.' "

1970120001 Merced River Gorge Elephant Rock RS Fall 12/n/a/1970 very large

(1) According to Jim Snyder (written commun., January 1990): "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." (2) According to Jim Snyder (written commun., February 25, 1992): According to Don Reid, the rock slide at Elephant Rock occurred in two stages, the first around December 1970. Dennis Miller witnessed the slide from the 'Cookie', which he was climbing. This slide created a scar and a new climbing route which Ray Jardine and Bill Critchlow did on the perimeter of the scar for a couple years while the route existed." (3) Aerial photographs bracket the rock slides at Elephant Rock between 1 November 1969 (YOSE 10-8) and 24 September 1971 (YOSE 28-244). (4) According to Jeffrey P. Schaffer (oral commun., January 1992): The rock slide at Elephant Rock occurred in mid-winter of 1971 (1970-71). (4) According to Robert Reece (National Park Service, 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 (National Park Service, oral commun., July 1991) remembers the event but cannot recall the date. [Refer to the narrative description of ID 1971030401 for more information on the two events.]

1971000001 Grand Canyon of Tuolumne Muir Gorge RS Spring n/a/n/a/1971 small

According to Jim Snyder (written commun., January 1990): "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."

1971000002 Union Point Chapel Wall RF n/a n/a/n/a/1971? medium

(1) According to Jim Snyder (written commun., 25 February 1992): "According to Don Ried, the rock-fall 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. (2) According to Jim Snyder (written commun., 4 March 1992): "Reid believes there have been additional rock falls at this

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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location in the 25-27 May 1980 Mammoth Lakes, California earthquake sequence, and more recently as well, enlarging the original scar."

1971030401 Merced River Gorge Elephant Rock RS Winter 3/4/1971 very large

(1) Photo caption by Jack Gyer from Yosemite (v. 41, n. 3, p. 3, June 1971): "Elephant Rock, which stands above the south side of the Merced River, about two miles upstream from Arch Rock, lost more of its face in a second slide which occurred the morning of March 4, this year. A large section of the upper part had broken loose in December of 1970, ripping out trees and generally changing the shape of the river bank below. The March slide was more violent than the earlier one and resulted in not only widening the slide path but also nearly denuding the slope of trees; a few battered trees still stand."

(2) According to Jim Snyder (written commun., 10 November 2003): "The photo caption above suggests that the second slide was much larger than the first. While the first took out some trees and changed the shape of the river bank, the second had a much wider path and removed nearly all the trees in its way. I'm [Snyder] not sure how to split the two in terms of volume, but it would seem that one quarter and three quarters might be a good division, or perhaps one third and two thirds of the total of 24,000 cubic meters. The amount of trees taken down might make me lean toward the first division more than the second."

1972000001 Yosemite Falls Yosemite Falls Trail RS Spring n/a/n/a/1972 small

According to Jim Snyder (written commun., January 1990): "On the Yosemite Falls Trail, a slide at the bottom of the upper falls gully damaged two switchbacks."

1973000001 Grizzly Peak Sierra Point Trail RS Spring n/a/n/a/1973 small

According to Jim Snyder (written commun., January 1990): "The Sierra Point Trail lost 45 steps in the chute with the cables."

1973060001 Yosemite Falls Yosemite Falls Trail RS Spring 6/n/a/1973 small

According to Jim Snyder (written commun., January 1990): "A rock slide on the Yosemite Falls Trail at the spring past 'Columbia Point', damaged three switchbacks. The source area was the decomposed section of rock not far above the spring. The switchbacks were rebuilt by Larry Roberts' crew after blasting the source area by climbing rangers Walt Dabney and others."

1973060002 Giant Staircase Liberty Cap RF Spring 6/n/a/1973 medium

According to Jim Snyder (written commun., January 1990): "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."

1974000001 Giant Staircase Nevada Fall RS Spring n/a/n/a/1974 small

According to Jim Snyder (written commun., January 1990): "On the Nevada Fall trail, failure of a large block in the chimney below 'Porcupine Spring' damaged five switchbacks."

1974000002 Sentinel Rock Four Mile Trail DS Spring n/a/n/a/1974 small

According to Jim Snyder (written commun., January 1990): "According to Jack Knierieman, on the Four Mile 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."

1974031501 Giant Staircase Vernal Fall RF Winter 3/15/1974 very small

(1) From the Mariposa Gazette (21 March 1974): Sheila V. Erskine died on the Mist Trail in a fall of ice and rock on 15 March 1974. A 500-pound chunk of rock and ice sent Erskine and her companions more than 400 feet down the trail. (2) From Ghiglieri and Farabee, Jr. (2007): "Erskine [aged 13] of Davis,

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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California, hiked the Mist Trail with 14 other kids when a "ton of ice" fell on them from 400 feet above. Erskine's head injuries proved fatal 2 days later." [This event is included in the inventory due to the Mariposa Gazette description of rocks involved in the fall]

1975000001 Hetch Hetchy Tiltill Creek RS Winter - Spring n/a/n/a/1975 small

According to Jim Snyder (written commun., January 1990): "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."

1975000002 Hetch Hetchy Wapama Falls RS Spring n/a/n/a/1975 small

According to Jim Snyder (written commun., January 1990): "According to Jack Knierieman, a small slide occurred in the loose talus on the upper side of the trail past Wapama Falls."

1975000003 El Capitan Southeast Face RF n/a n/a/n/a/1975 medium

From Rempel (1983): "An even larger slab [larger than the 1976 Footstool rock fall from the Southeast Face of El Capitan; see ID 1976000001] fell from the East Buttress in 1975".

1975050001 El Capitan Southeast Face RF Spring 5/n/a/1975 medium

According to Park Geologist Greg Stock: Report from a rock climber on Middle Cathedral Rock of a rock fall from the southeast face of El Capitan, near the "Grey Circle" on the climbing route "Zodiac". The climber reported two events in the same day, with the second event being the larger of the two. The second event produced a substantial dust cloud, obscuring the climber's view of Sentinel Rock. A couple of boulders reportedly tumbled down the talus slope "just about to Northside Drive".

1976000001 El Capitan Southeast Face RF n/a n/a/n/a/1976 large

According to Park Geologist Greg Stock: (1) A rock fall occurred in about 1976 near 'The Footstool', a small pedestal at the base of the southeast face, below and east of the North America diorite formation. Climbers Werner Braun, Marco Milano, and Chris Falkenstein were retrieving ropes from another climber on the wall when they saw cracks appearing in a large section of the cliff just to the east of the Footstool and at the base of the wall. (2) According to rock climber Chris Falkenstein (written commun., 27 April 2007): "We went over to the right of the Footstool and watched as the morning sun warmed the rock, it would send cracks racing across the wall and rocks and dust would fall out. After a little bit of this we decided we should move and went to the base of the Footstool. Soon after I remember the whole section of wall falling out, a huge area (200 x 200 feet), and we ran to the west side of the Footstool and the slide just missed us. It went all the way to the road. It became so dusty that we could not see for 1/2 hour..." The rock fall completely altered the first several pitches of the 'El Capitan Tree Direct' climbing route.

1976000002 El Capitan Horsetail Falls RS n/a n/a/n/a/1976-77 medium

According to Jim Snyder (written commun., 25 February 1992): "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 rock-fall scar."

1977000001 Little Yosemite Valley Bunnell Point RF Spring n/a/n/a/1977 very small

According to Jim Snyder (written commun., January 1990): "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 Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1977000002	Yosemite Falls	Upper Yosemite Falls	RF	Spring	n/a/n/a/1977 large
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(1) From Wiley (1977): "One of Yosemite's most recent, and most noticeable, examples of lightning's force can be seen close to the west edge of Upper Yosemite Fall. A 250-foot flake of rock has been peeled off this massive granite surface to expose the color and texture of that portion of the Sierra's skeleton. The surrounding rock still is covered by a layer of living lichens which, growing slowly, will take many years to cover the newly exposed surface... The first [person] to notice its passing detected something "odd" about the way the Falls looked one Monday morning. Some took photos to compare with others they had of its former appearance. Few had heard the thunderous crash, and fewer knew the real story, 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. As he watched, he must have felt somewhat like the Indians might have when they witnessed the heavens unleashing their fearsome might: a humbling respect for the variety of forces which shape the Yosemite environment." [2 photos accompany the article.] (2) According to Jim Snyder, a lightning trigger was questioned at the time, but rain did occur.

1977000003	Yosemite Falls	Yosemite Falls Trail	RS	Spring	n/a/n/a/1977 small
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According to Jim Snyder (written commun., January 1990): "According to Bill Burgen, there was a slide on the Yosemite Falls Trail at the spring east of 'Columbia Point'."

1977000004	Illilouette Gorge	Illilouette Gorge	RF	Spring	n/a/n/a/1977 very small
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According to Jim Snyder (written commun., January 1990): "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."

1977000005	Panorama Cliff	Panorama Point	RF	Spring	n/a/n/a/1977 large
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According to Jim Snyder (written commun., 29 April 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."

1977000006	Yosemite Falls	Yosemite Falls Trail	RS	Spring	n/a/n/a/1977 small
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According to Jim Snyder (written commun., January 1990): "According to Jack Knierieman, there was a small slide on the trail in the upper falls gully of the Yosemite Falls trail."

1977000007	Glacier Point	Four Mile Trail	RS	Spring	n/a/n/a/1977 small
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According to Jim Snyder (written commun., January 1990): "On the Four Mile Trail a small slide damaged two switchbacks in the chute below Union Point."

1977062801	Tenaya Canyon	Hidden Falls	DF	Summer	6/28/1977 large
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(1) According to Ghiglieri and Farabee, Jr. (2007): A wife and husband (24-year-old Bryna Rae Rackusin and 25-year-old Jeffrey L. Rackusin) had been swimming at Hidden Falls along Tenaya Creek upstream of Mirror Lake on the afternoon of 28 June 28 1977. When the weather turned threatening the two decided to leave by hiking down a faint "social" trail adjacent to the creek. Upstream an afternoon thunderstorm delivered substantial precipitation to the Tenaya Creek watershed, most intensely on nearby Half Dome. Marble-sized hail twice forced the Rackusins to seek shelter under an overhanging cliff. Within view of the Rackusins and also hiding under a ledge, visitor David Mahvi heard a "rumbling" and "whooshing" from up-canyon. Peering upstream he saw a "large amount of mud and debris coming down the canyon towards him". He yelled to the Rackusins, "Watch out!", then climbed higher for

safety. When Mahvi looked back over his shoulder, he saw Bryna Rackusin already caught standing in the flood. The muddy flow quickly knocked her off her feet and started to carry her downstream. Almost immediately, however, her foot became wedged between a boulder and a log. Jeffrey Rackusin waded in to assist his wife. Three other visitors - Robert Rogers, Bob Dubuison, and Clark Hine - appeared and began to aid the Rackusins, both of whom were now engulfed by the rising flood. The three men joined Jeffrey in attempting to extricate Byrna, but after twenty minutes of effort she remained pinned. At that point a second, higher flood wave came "gushing down Tenaya Creek from above". It knocked Byrna loose and swept her away, and also carried off Jeffrey Rackusin and Bob Dubuison. Dubuison managed to make his way to shore, but both Rackusins were swept downstream where they drowned. (2) On 14 July 1977, Ranger Don Coehlo interviewed Interpretive Ranger David Balogh, who observed the storm event from Glacier Point: "Ranger Balogh related that at approximately 1500 hours he observed an extremely large thunder storm building up over the Merced River drainage with an extremely large amount of precipitation falling beneath it... The storm moved fairly rapidly towards Tenaya Canyon; he stated that Clouds Rest literally disappeared in the cloud. The storm moved over Half Dome but the dome did not disappear. Balogh states he observed sheets of water coming off of Half Dome...as if someone had turned a shower nozzle on from above... He observed very large amounts of water running down [Clouds Rest] into Tenaya Canyon... [Balogh] states that he has worked in Yosemite for five summers and has never seen anything like this storm... storms of such intensity are quite rare in the Sierra." (3) In an National Park Service incident report dated 28 June 1977, Ranger Don Coelho states the following: "[Myself] and Ranger Calkings walked up the watercourse [after the flow had diminished] and observed the following: much loose gravel and rock in a very unstable condition. Unstable conditions suggest recent movement to their existing locations. The rocks varied from small gravel to grapefruit size. The bark stripped off all live trees and shrubs bordering the watercourse from top to bottom. The growth looks as if it had been sandblasted, suggesting movement of water with much rapidity and force... Residue shows the slide consisted of water, sand, small rock and gravel and much mulch and leafy type material... Watercourse appears to be an old course, but by looking at the vegetation along its borders it appears to have been widened by approximately ten feet on both sides. ... The spot where the witnesses state the victims had been standing... shows a new vertical cut of six and one half feet deep by sixteen yards wide down through the soil. Creek edge shows a four foot diameter Douglas Fir completely uprooted, lying on its side.... The water came down a large rock gully named "Northeast Gully", below Ahwiyah Point." (4) Balogh (1978) described the thunderstorm and associated flood: "From Glacier Point the bottom of the cloud seems to erupt, and the whole Merced River drainage above Nevada Falls disappears, enveloped by a gray curtain...Slowly, almost imperceptibly the cloud moves northward towards Clouds Rest, the divide between the Merced River drainage and the narrow glacial canyon of Tenaya Creek. Rain falls on Half Dome, Clouds Rest completely disappears, not in the cloud, but in the rain. So much water falls on Half Dome that water begins to streak down its massive flanks... Thousands of gallons of white water in hundreds of channels flow down to Yosemite Valley. All of Tenaya Canyon disappears from view... 4:00 p.m. The cloudburst moves from Clouds Rest toward Mt. Hoffmann. When Clouds Rest becomes visible the enormity of the storm becomes apparent. In every possible path on the huge mass of granite, water, not in rivulets, but in torrents descends towards Tenaya Creek... Clouds Rest is white on top from snow and below the 8,000 [foot] level from water, sliding, free-falling, pushing, lubricating, washing, turning soil to mud; moving more earth in five minutes than a hydraulic gold mine in a day... Hikers on the Tenaya Trail switchbacks ran for cover. Most said that they could not see the storm until it was upon them. Many escaped with only a few bruises. Two did not. Mudslides and the flash flood took two lives shortly after 4:00 p.m. above Mirror Lake. Tenaya Creek roared into Mirror Lake like a runaway express train. Almost all of the sand bar marking the most recent filling of the lake disappeared within ten minutes.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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But the presence of the lake saved further damage and possible loss of life downstream, for the energy of the running water was dissipated by the lake."

1978000001 Hetch Hetchy Wapama Falls RS Spring n/a/n/a/1978 large

According to Jim Snyder (written commun., January 1990): "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."

1978000002 Yosemite Falls Yosemite Falls Trail RS Spring n/a/n/a/1978 small

According to Jim Snyder (written commun., January 1990): "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."

1978090001 Half Dome Half Dome RS Summer 9/n/a/1978 small

According to Jim Snyder (written commun., January 1990): "According to Bill Wendt, 24 uprights were lost in a rock slide midway up the cables on Half Dome."

1980000001 Half Dome Half Dome RS Spring n/a/n/a/1980 very small

According to Jim Snyder (written commun., January 1990): "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."

1980011201 Indian Canyon Castle Cliffs RF Winter 1/12/1980 large

(1) According to the unpublished National Park Service Yosemite Flood Report (1980): "The possibility of a flood was announced with authority at 06:17 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." (2) From Jim Snyder (written commun., January 1990): "Flooding in the Castle Crags area damaged 50 yards of the valley horse trail behind the Government maintenance yard."

1980011202 Indian Canyon Castle Cliffs DF Winter 1/12/1980 medium

According to the unpublished National Park Service Yosemite Flood Report (1980): "...Two small [debris flows] occurred at approximately 11:00 in the same course" [east of 'Hot Rock Creek' below Castle Cliffs].

1980011203 Sentinel Rock Four Mile Trail RS Winter 1/12-13/1980 medium

According to Jim Snyder (written commun., January 1990): "The Four Mile Trail lost sections of two switchbacks below the creek crossing from a slide off the western shoulder of Sentinel Rock."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1980011301	Merced River Gorge	Big Oak Flat Road	RS	Winter	1/13/1980	small
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According to the unpublished National Park Service Yosemite Flood Report (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."

1980011302	Wawona Road	Wawona Campground	RS	Winter	1/13/1980	medium
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According to the unpublished National Park Service Yosemite Flood Report (1980): "Prior to midnight, a slide north of Wawona Campground closed Highway 41 to all traffic."

1980052501	Grizzly Peak	Sierra Point	RF	Spring	5/25/1980	medium
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(1) From Wieczorek et al. (1989): "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." (2) From Gilliam (1982): "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." (3) From Jim Snyder (written commun., January 1990): "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." (4) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.1 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 9 a.m. on 25 May 1980.

1980052502	Cathedral Rocks	Cathedral Spires	RF	Spring	5/25/1980	medium
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(1) According to John Dill (oral commun., 28 May 1980): A rock avalanche at Cathedral Spires included trees and ripped out pitons along climbing routes. (2) From Jim Snyder (written commun., 25 February 1992): "According to Don Reid the slide occurred on the day of the earthquake [25 May 1980], at 09:00 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." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.1 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 09:00 on 25 May 1980.

1980052506	Merced River Gorge	Pulpit Rock	RS	Spring	5/25-27/1980	small
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(1) According to Dick Riegelhuth, National Park Service (oral commun., 28 May 1980): A rock slide occurred at Pulpit Rock during this earthquake. (2) From U.S. Geological Survey, National Earthquake Information Center (2004): Earthquakes occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley of M6.1 on 25 May 1980 and M6.0 on 27 May 1980.

1980052507	North Dome/Washington Column	Mirror Lake Trail	RS	Spring	5/25-27/1980	medium
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(1) According to Jim Snyder (written commun., 8 March 1981): "There was another slide during the earthquake around Memorial Day. I [Snyder] don't know whether it occurred that Sunday or Tuesday [25 May or 27 May]. 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 [Snyder] would guess. ... Below North Dome is the 6400 foot contour mark. 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." (2) From U.S. Geological

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Survey, National Earthquake Information Center (2004): Earthquakes occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley of M6.1 on 25 May 1980 and M6.0 on 27 May 1980.

1980052701 Merced River Gorge El Portal Road/Arch Rock RF Spring 5/27/1980 medium

(1) From John Tinsley and Gerald Wiczorek [U.S. Geological Survey] letter to Robert Binneweis, Yosemite National Park Superintendent (written commun., 17 June 1980): "National Park Service employees at Arch Rock Entrance Station reported rock falls occurring at about 8:00 a.m. on 27 May 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." (2) From Wiczorek (1981): "Bouncing boulders, several meters in dimension, from a rock fall near Arch Rock Entrance Station narrowly missed a park employee." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.0 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 8 a.m. on 27 May 1980.

1980052702 Sentinel Rock Four Mile Trail RF Spring 5/27/1980 small

(1) According to Jim Snyder (written commun., January 1990): "During the earthquake on this date, the Four Mile Trail received rock fall from Sentinel Rock just below the creek crossing." (2) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.0 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 8 a.m. on 27 May 1980.

1980052703 Panorama Cliff Nevada Fall RF Spring 5/27/1980 very small

(1) According to Jim Snyder (written commun., January 1990): "The Nevada Fall Trail had one large rock on it just below Clark Point." (2) According to Jim Snyder (written commun., 7 April 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." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.0 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 08:00 on 27 May 1980.

1980052704 Sentinel Rock Sentinel Creek RS Spring 5/27/1980 large

(1) According to Jim Snyder (written commun., January 1990): "There was a large slide off the cliff on the west side of Sentinel Creek, a slide of soil and rock." (2) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.0 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 08:00 on 27 May 1980.

1980052705 Indian Canyon Castle Cliffs RF Spring 5/27/1980 small

(1) According to Jim Snyder (written commun., January 1990): "There was a block that fell from Castle Cliffs toward the maintenance yard during the earthquake as well." (2) According to Jim Snyder (written commun., 7 April 1992 and 4 November 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." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M6.0 occurred at Mammoth Lakes, California, about 70 km east of Yosemite Valley at about 08:00 on 27 May 1980.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1980100401 Giant Staircase Clark Point RF Fall 10/4/1980 medium

(1) According to Jim Snyder (written commun., January 1990): "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." (2) According to Jim Snyder (written commun., 7 April 1992): "The rock fall happened in the morning before 09:00-10:00, 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 [Snyder] 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 live oak 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." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): There was a M 4.1 earthquake at 08:38 P.S.T. on 4 October 1980 near Mammoth Lakes, California about 61 km from Clark Point. (4) According to historical data (Keefer, 1984) this earthquake was probably not strong enough at this distance to trigger rock slides in Yosemite Valley.

1980100601 Yosemite Falls Upper Yosemite Falls RF Fall 10/6/1980 very small

(1) According to John Dill, National Park Service (oral commun., October, 1980): A rock fall from just west of the base of the Upper Yosemite Fall at between 13:00-13:30 on 6 October 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. (2) According to Jim Snyder, this rock fall-scar was adjacent to that of an earlier rock fall described as ID 1977000002.

1980100701 Royal Arches Rhombus Wall RS Fall 10/7/1980 small

According to Scott Thornileg, National Park Service (oral commun., 8 October 1980): "I [Thornileg] heard a rock slide from the Royal Arches behind the Ahwahnee Hotel at 22:50 on 7 October 1980."

1980111601 Yosemite Falls Forbidden Wall RF Fall 11/16/1980 large

(1) According to Jim Snyder (written commun., January 1990): "At just after 12 noon on 16 November 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 [subsequent analysis increased the number of injured to 19; see Ghiglieri and Farabee, Jr., 2007]. The 4000-ton pendant 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. (2) From the San Francisco Chronicle (4 July 1982): "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 [source] ... to tackle the source 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) (3) From the San Francisco Chronicle (18 November 1980): "At 12:06 p.m., rock and debris suddenly rumbled onto a 600-yard stretch of the precipitous, zigzag 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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jagged rubble that covers the trail to depths well over 10 feet..." (4) From the San Francisco Chronicle (1980): "A chunk of rock 200 yards long and 65 yards wide tore loose 1,600 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.] (5) From the Palo Alto Times (18 November 1980): "A 10-to-20 foot layer of rock and dirt covers the trail." [Photo shows rock fall and trail.] (6) According to Jim Snyder (written commun., 24 February 1981): "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 [US Geological Survey] 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." (7) According to Malcolm Clark (written commun., 16 March 1992): "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." [Clark's photograph shows at least one boulder falling all the way to the base of Lower Yosemite Falls.] (8) According to Jim Snyder (written commun., 24 February 1981): "About thirty minutes before the rock [fall], sounds like gunfire were heard, as the slab of some 270 feet long, weighing about 4,400 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." (9) In reviewing National Park Service Search and Rescue files for the book "Off the Wall: Death In Yosemite", author Butch Farabee, Jr., determined that at least 19 people were injured by the rock fall (Ghiglieri and Farabee, Jr., 2007).

1981000001	Hetch Hetchy	Beehive Switchbacks	RS	Winter - Spring	n/a/n/a/1981	small
According to Jim Snyder (written commun., January 1990): "A rock slide from above the Hetch Hetchy Road to Lake Eleanor, the same source as the 23 February 1985 event, 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."						

1981000002	Wawona	Chilnualna Falls	DF	Spring	n/a/n/a/1981	medium
According to Jim Snyder (written commun., January 1990): "The Chilnualna Fall trail [was] covered [for] about 150 feet with debris. This was a debris flow type of slide from heavy rains."						

1981030401	Merced River Gorge	El Portal Road	RS	Winter	3/4/1981	very small
According to Doug Erskine, National Park Service (written commun., 9 March 1991): "At approximately 4:30 p.m. on 4 March 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						

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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 fall line 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."

1981030402 Merced River Gorge El Portal Road RS Winter 3/4/1981 large

See ID 1981030401

1981040901 Grizzly Peak Sierra Point RF Spring 4/9/1981 medium

According to Jim Snyder (written commun., January 1990): "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 source area for the 25 May 1980, earthquake generated rock fall that destroyed the Sierra Point Trail."

1981050001 Glacier Point Four Mile Trail RS Spring 5/n/a/1981 small

According to Jim Snyder (written commun., January 1990): "A slide of loose rock occurred in the chute below Union Point on the Four Mile 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 no longer hold the weight. The rock [slide] brought much loose material with it as it went down the chute."

1981050801 Yosemite Falls Forbidden Wall RF Spring 5/8/1981 medium

(1) According to Jim Snyder (written commun., January 1990): "A blast on the Yosemite Falls Trail removed a 500-ton pendant remaining at the top of the source area from the 16 November 1980, rock fall. (2) According to Snyder (1981): "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 16 November. 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."

1981110001 Cathedral Rocks Lower Cathedral Rock RF Fall 11/n/a/1981 medium

According to Jim Snyder (written commun., January 1990): "One quarter mile east of 'Bridalveil Straightway' 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."

1981120801 Merced River Gorge Elephant Rock RS Winter 12/8/1981 very large

According to Jim Snyder (written commun., 25 February 1992): According to Don Reid 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. (2) According to Jose Lopez, National

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Park Service Trails (oral commun., May 2012), this event occurred on 8 December 1981 at about 23:00. Lopez recalls that the date coincided with the one-year anniversary of the assassination of John Lennon.

1982000001 Grand Canyon of Tuolumne Gardiner Camp RS Fall n/a/n/a/1982 very small

According to Jim Snyder (written commun., January 1990): "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."

1982000002 Grand Canyon of Tuolumne Gardiner Camp RS Fall n/a/n/a/1982 very small

According to Jim Snyder (written commun., January 1990): "Another small rock slide came down on the Tuolumne River Trail about 1.75 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."

1982000003 Tenaya Canyon Quarter Domes RF Winter n/a/n/a/1982? medium

(1) According to Jim Snyder (written commun., 25 February 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 on West Quarter Dome". (2) In Meyers and Reid (1987, p. 257) an annotated photograph of Quarter Domes shows a rock fall area on the North Face of West Quarter Dome.

1982000004 Giant Staircase Mist Trail RF Winter n/a/n/a/1982-1983 very small

According to Jim Snyder (written commun., January 1990): "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 20 March 1983."

1982040301 Merced River Gorge Cookie Cliff RS Spring 4/3/1982 extremely large

(1) According to Jim Snyder (written commun., January 1990): "Between the 'Cookie Cliff' and the junction of the old Coulterville Road with Highway 140, a large rock 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. (2) According to Malcolm Clark (written commun., April 1982): "The southwest wall of slide is on a main joint plane that looks dirty. Some fresh fractures in in the center of slide source. Overhanging rock at head of slide bedrock (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." (3)

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According Dick Ewert (oral commun., March 2012), as abstracted by Greg Stock: Park Ranger Dick Ewert, dressed in his National Park Service uniform, was the first on-scene at the rock slide. He and a companion left Yosemite Valley for El Portal in separate vehicles at about 22:00. He was in the second vehicle, and stopped for about fifteen minutes at a friend's house located that the former Cascades housing area just upstream of the Cookie Cliff area. When he left the house at about 22:30 he quickly encountered a large tree and boulder across the road. He returned to his friend's house at Cascades to alert Park Dispatch that a front-end loader would be needed to remove the tree and boulder. Ewert decided to return to the slide area to look around while he waited for the front-end loader. With a flashlight, he began walking down the road and quickly realized that the slide was far larger than he originally thought, with many house-sized boulders where the road used to be. Ewert immediately thought of his companion, who had driven through this area about 15 minutes prior, and began searching for her vehicle in the debris. As he worked his way across the slide, he lost track of the road due to the accumulation of debris. He could hear small boulders still falling above, and noted a creek flowing through the debris that he hadn't noticed before [this was effluent from the broken sewer line]. He did not find evidence of a vehicle [she had passed through just before the slide occurred]. He could, however, see headlights through the mist up above him, so climbed back up to the road. There he encountered a park visitor, clearly upset by the situation, who demanded to know when the road would be reopened. Ewert, having just negotiated the debris field, replied "About six weeks, sir. If you care to wait, please make sure your car is pulled completely off the pavement."

1982040401 Big Oak Flat Road Hodgdon Meadow DS Spring 4/4/1982 medium

(1) According to Jim Snyder (written commun., January 1990): "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." (2) According to Jim Snyder (written commun., 7 April 1992): "Rains combined with a steep road-cut face caused a debris slide out of a saturated bank."

1982040801 Merced River Gorge Old Coulterville Road RS Spring 4/8/1982 large

According to Jim Snyder (written commun., January 1990): "A 5,000-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."

1982061001 Yosemite Falls Forbidden Wall RF Spring 6/10/1982 very small

According to Jim Snyder (written commun., January 1990): "According to Michelle Orfetel, a rock about 400 pounds in [weight] fell from ledges above switchback 50 and crossed 3 switchbacks on the Upper Yosemite Fall Trail before stopping in the fresh talus of the 16 November 1980 rock fall."

1982102501 Yosemite Falls Forbidden Wall RF Fall 10/25/1982 small

(1) According to Jim Snyder (written commun., January 1990): "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, a weathered 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 on 24 October (0.31 inches [0.78 cm]) and 25 October 1982 (1.05 inches [2.57 cm]) and at 04:00 a lightning strike hitting a pine 100 yards west of the source area. Lightning 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 lightning hit a water-filled joint or fracture. A resultant steam explosion possibly caused the failure of this flake, not far away from the

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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 lightning strike according to Bill Burgen, living in Lost Arrow housing, who heard it with the thunder." (2) From Jim Snyder (written commun., 4 November 1992): "As a thin flake that broke up considerably as it fell, the rock did not go much past the [Yosemite Falls] trail."

1982102502 Yosemite Falls Forbidden Wall RF Fall 10/25/1982 medium

According to Jim Snyder (written commun., January 1990): "On the Yosemite Falls Trail, after another day of hard rain (2.75 inches [7 cm]), a rock fall occurred just after midnight 25 October 1982. 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 in 1873-1877. A crude estimate of what fell would be roughly 325 cubic yards."

1983000001 Glacier Point Road Badger Pass RS Winter - Spring n/a/n/a/1983 small

According to Jim Snyder (written commun., January 1990): "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 27 June 1983. The winter of 1983 was heavy and late which was no doubt responsible for the rock movement."

1983000002 Smedberg Lake Benson Pass RS Spring n/a/n/a/1983 very small

According to Jim Snyder (written commun., January 1990): "At Benson Pass, on the first switchback down the Smedberg Lake side, a large weathered rock 3 x 3 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."

1983050201 Panorama Cliff Panorama Point RF Spring 5/2/1983 medium

According to Jim Snyder (written commun., 27 January 2011): "A rock fall from the Panorama Wall above the horse trail to Nevada Fall was triggered by the M6.7 Coalinga earthquake on 2 May 1983. Yosemite Institute instructor Bob Pavlik "was returning with a group of students from Nevada Falls[;] we were approaching the bend of the trail near the viewpoint where you can see the Glacier Point apron. I noticed a plume of granite dust to the left of me, near Illilouette Falls, and then saw a large boulder tumbling through the sky and heard the crack, probably the sound of the rock peeling off the wall. The boulder hit the wall and exploded into smaller pieces (still formidable) and the canyon filled with dust. We stood awestruck; I had never seen or heard anything like it." Pavlik had not felt the earthquake at 4:42 pm [3:42 pm PST] on the trail but heard about it as soon as he got back to the Institute office. A specific source area for the Panorama Point rock fall was not determined at the time, but observations indicate that the source was well west of the Nevada Falls Horse Trail, probably in the vicinity of Panorama Point. Rock fall debris probably extended as far west as Illilouette Creek."

1983050202 Grizzly Peak Sierra Point RF Spring 5/2/1983 small

According to Jim Snyder (written commun., 27 January 2011): "A rock fall occurred from the ridge between Sierra Point and Grizzly Peak on the western shoulder of Half Dome and east of Happy Isles. The impact of the rock fall debris was near the high point of the John Muir Trail downstream from the Vernal Falls Bridge. The rocks did not come down from the vicinity of the 1981 Grizzly Peak blasting [National Park Service action following earthquake-triggered rock falls in May of 1980] location but

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were instead east of that location, more toward Grizzly Peak. Most of the rock debris was caught in the talus there or on Anderson's old trail to Vernal Fall, which acts as a catch basin for much of the rock coming down in that area. This rock fall was also located east of the 1986 triple rock fall (IDs 1986020701, 1986021301, and 1986030801) that damaged the John Muir Trail just downhill from its junction with Anderson's old trail. This rock fall was triggered by the 2 May 1983, M6.7 Coalinga earthquake, which occurred at 4:42 pm [3:42 pm PST]."

1983050203 Sentinel Rock Sentinel Rock RF Spring 5/2/1983 small

According to Jim Snyder (written commun., 27 January 2011): "The east side of Sentinel Rock often sheds rock into the rough gully below it and sometimes leaves rock debris on the Four Mile trail at the gully crossing. The east side of Sentinel Rock was the location of a rock fall that came down during the 2 May 1983, M6.7 Coalinga earthquake."

1983050204 Sentinel Rock Sentinel Rock RF Spring 5/2/1983 medium

According to Jim Snyder (written commun., 27 January 2011): "A large slab fell from the west side of Sentinel Rock and tumbled into a large gully that abuts the corner of the 7th and 8th switchbacks above the foot of the Four Mile Trail. This corner is the farthest west extent of the trail. There was no damage to the Four Mile Trail in this area from the [M6.7 Coalinga] earthquake or the rock fall it generated; however, rock fall from the west side of Sentinel has occasionally triggered debris flows or rock fall that impact this corner via a subsidiary channel maybe 50 yards up from the corner. Because of those impacts, National Park Service Trails rebuilt the trail in that area in 1987 to handle loads from the subsidiary channel more effectively in the future."

1983052001 Sentinel Rock Sentinel Creek DS Spring 5/20/1983 large

According to Jim Snyder (written commun., January 1990): "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."

1984000001 Glacier Point Four Mile Trail RS Spring n/a/n/a/1984 very small

According to Jim Snyder (written commun., January 1990): "On the Four Mile Trail at the junction of the original Four Mile Trail with the new Four Mile 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 live oak shrubs had broken up the rock outcrop that failed."

1984000002 Glacier Point Four Mile Trail RS Spring n/a/n/a/1984 very small

According to Jim Snyder (written commun., January 1990): "On the Four Mile 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."

1984000003 Yosemite Falls Forbidden Wall RF Fall n/a/n/a/1984 small

According to Jim Snyder (written commun., January 1990): "On the second switchback corner above the 1980 rock [fall] damage on the Yosemite Falls Trail, a slab about 3 x 6 x 6 feet broke off 200 feet above the trail and came down on the corner, bringing some live oak 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."

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1984050101 Glacier Point Ledge Trail RF Spring 5/1/1984 small

(1) According to Jim Snyder (written commun., January 1990): "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 28 April 1984, but the slide cannot be attributed to that event.... 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'." (2) According to Fred Lester, U.S. Geological Survey (unpub. data, August 1987): There were no earthquakes greater than M4 recorded in central California from 28 April to 1 May 1984.

1984071701 Basket Dome Snow Creek Trail DF Summer 7/17/1984 medium

According to Jim Snyder (written commun., January 1990): "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."

1984101201 Sentinel Rock Sentinel Rock RF Fall 10/12/1984 small

From Jim Snyder (written commun., January 1990): "According to John Schelhas, a small slab fell off Sentinel Rock to the Four Mile 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."

1985020001 Hetch Hetchy Wapama Falls RS Winter 2/n/a/1985 medium

According to Jim Snyder (written commun., January 1990): "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."

1985022301 Hetch Hetchy Beehive Switchbacks RS Winter 2/23/1985 small

According to Jim Snyder (written commun., January 1990): "Scott Emmerick, Hetch Hetchy Ranger 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."

1985030001 Sentinel Rock Sentinel Creek DF Winter 3/n/a/1985 large

According to Steve Botti, National Park Service (oral commun., 21 May 1985): From the upper drainage of Sentinel Creek a debris flow initiated in colluvium, talus and channel fill 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.

1985040001 Glacier Point Glacier Point RS Spring 4/n/a/1985 small

According to Steve Botti, National Park Service (oral commun., 21 May 1985): In late April 1985 a rock slide came off the northeast cliff of Glacier Point.

1985072001 Yosemite Falls Yosemite Falls Trail RF Summer 7/20/1985 small

According to Jim Snyder (written commun., January 1990): "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

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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 an intense summer rain the day before."

1985080001 Taft Point Taft Point DF Summer 8-9/n/a/1985 small

According to Steve Botti, National Park Service (oral commun., 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."

1985092501 Yosemite Falls Forbidden Wall RF Fall 9/25/1985 small

According to Jim Snyder (written commun., January 1990): "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 source area lies on the lower edge of a band of more thinly jointed rock."

1985100701 Sentinel Rock Sentinel Rock DS Fall 10/7/1985 medium

According to Jim Snyder (written commun., January 1990): "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- Four Mile Trail several feet deep."

1985110001 Taft Point Taft Point DF Fall 11/n/a/1985 medium

According to Steve Botti, National Park Service (oral commun., 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."

1985112101 Glacier Point Ledge Trail RS Fall 11/21/1985 small

According to Jim Snyder (written commun., January 1990): "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'."

1985112901 Three Brothers Middle Brother RS Fall 11/29/1985 large

(1) According to Jim Snyder (written commun., January 1990): "From above 'Rixon's Pinnacle' 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 source 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."

1985120801 Three Brothers Middle Brother RF Fall 12/8/1985 medium

From Jim Snyder (written commun., January 1990): "According to 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 source area 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

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on 8 December 1985 although the precise timing of the rock slide is not known. At 0:17 PST on 8 December 1985, a M 2.1 occurred near Bridgeport, California.; at 15:13 PST, a M 2.9 occurred near Harden Flat, California about 32 km from the valley; and at 23:56 PST, a M 3.5 occurred near Willow's Spring, along California State Hwy 395, about 50 km northeast of Yosemite 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."

1986000001 Indian Canyon Castle Cliffs RS Spring n/a/n/a/1986 medium

According to Jim Snyder (written commun., January 1990): "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."

1986013001 Indian Canyon Castle Cliffs RS Winter 1/30/1986 small

According to Steve Botti, National Park Service (oral commun., 30 January 1986): A rock slide occurred on 30 January 1986, at 08:50 from the 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.

1986020001 Cathedral Rocks Lower Cathedral Rock DF Winter 2-3/n/a/1986 medium

According to Jim Snyder (written commun., 16 March 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."

1986020701 Grizzly Peak Vernal Fall RS Winter 2/7/1986 medium

(1) From Snyder (1986a): "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 live oaks 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 live oaks 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." (2) From Wieczorek et al. (1989): "The first [Sierra Pt.] rock slide [was] on 7 February (13:30 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."

1986021301 Grizzly Peak Vernal Fall RS Winter 2/13/1986 medium

(1) From Snyder (1986a): "After heavy rain, a second block fell from the 7 February source area above the Vernal Fall trail, a block of about 1,200 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. (2) From Wieczorek et al. (1989): "The second [Sierra Point] rock [slide] (1100 metric tons) was on 13 February 1986 coincided with intense rain (6.1 cm on 13 February) and flooding in Yosemite Valley ...".

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1986021701 Giant Staircase Clark Point DF Winter 2/17-19/1986 large

From Snyder (1986b): "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."

1986021702 Sentinel Rock Sentinel Creek DS Winter 2/17-19/1986 large

From Snyder (1986b): "On the Four Mile 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 x 8 x 6 feet was on the trail in the main channel east of Sentinel Creek."

1986021703 Half Dome Mirror Lake Trail DF Winter 2/17-19/1986 medium

From Snyder (1986b): "On the south side of the Mirror Lake Loop [trail] were several two-foot deep mud and rock deposits from talus below Half Dome."

1986021704 Sentinel Rock Sentinel Creek DF Winter 2/17-19/1986 large

(1) From Snyder (1986b): "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." (2) According to Steve Botti, National Park Service (oral commun., 19 February 1986): 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.

1986021705 Sentinel Rock Sentinel Creek DF Winter 2/17-19/1986 medium

From Snyder (1986b): "17-19 February 1986: ...There was also debris flow across the trail at two other locations with traditional washes between Sentinel and the 'El Capitan Road' junction."

1986021706 Taft Point Taft Point DF Winter 2/17-19/1986 medium

(1) From Snyder (1986b): "17-19 February 1986: ... There was also debris flow across the trail at two other locations with traditional washes between Sentinel and the 'El Capitan Road' junction." (2) According to Steve Botti, National Park Service (oral commun., 19 February 1986): The channel below Taft Point has been very active, debris flows have covered Southside Drive.

1986021707 Merced River Gorge El Portal Road/Windy Point RS Winter 2/17-19/1986 medium

From Snyder (1986b): "17-19 February 1986: The El Portal Road suffered a rock slide about a quarter of a mile below Arch Rock, in the turn above 'Windy Point', a slide that took three days to clear."

1986021708 Union Point Union Point DS Winter 2/17-19/1986 small

From Wieczorek, U.S. Geological Survey (unpub. data, 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.

1986021709 Grand Canyon of Tuolumne Pate Valley DF Winter 2/17-19/1986 medium

(1) From Snyder (1986b): "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." (2) According to Jim Snyder (written commun., 7 April 1992): "There was a considerable volume of material, nearly all fines, in this flow."

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1986021801 Glacier Point Ledge Trail DF Winter 2/18/1986 large

(1) From Snyder (1986b): "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." (2) According to Jim Snyder (written commun., 7 April 1992): "There was a considerable amount of debris in this flow including some large rocks. 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'." (3) According to Steve Botti, National Park Service (oral commun., 19 February 1986): Debris flows from Glacier Point partially buried several buildings in Curry Village during the evening of 18 February. On the talus slope, the debris flow had levees, and contained sand carrying small boulders. The most debris was produced, and the worst problems occurred, on the evening of 18 February. Photos of rocky debris around shower house and cabins.

1986030001 Glacier Point Four Mile Trail RF Winter 3/n/a/1986 very small

According to Jim Snyder (written commun., January 1990): "There was a rock fall in the vicinity of the 'Italian Wall' on the Four Mile Trail. Two rocks, 3 feet x 4 feet 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 x 4 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."

1986030002 Glacier Point Four Mile Trail RF Winter 3/n/a/1986 very small

According to Jim Snyder (written commun., January 1990): "One rock, 5 x 4 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."

1986030801 Grizzly Peak Vernal Fall RS Winter 3/8/1986 large

(1) From Snyder (1986a): "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 7 February, 13 February, and 8 March 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." (2) From Jim Snyder (written commun., January 1990): "The rock slides of 7 February and 13 February 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 rock face 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 rock face beneath. On 6 March, 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 grass and pine needles from a

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nearby pine tree growing in the joint." (3) From Wieczorek et al. (1989): "On 8 March, 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."

1986040001 Glacier Point Four Mile Trail RF Spring 4/n/a/1986 very small

According to Jim Snyder (written commun., January 1990): "On the Four Mile Trail, two rocks, 3 x 3 x 2 feet and 5 x 4 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 source 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."

1986040201 Yosemite Falls Yosemite Falls Trail RS Spring 4/2/1986 small

According to Jim Snyder (written commun., January 1990): "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 20 July 1985 slide. Rocks up to 2 tons each crossed the trail."

1986050001 Little Yosemite Valley Bunnell Point RS Spring 5-6/n/a/1986 very small

According to Jim Snyder (written commun., January 1990): "At the Bunnell Point switchbacks, on the seventh switchback, on the Merced River, a block 6 x 1.5 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."

1986050601 Indian Canyon Castle Cliffs RF Spring 5/6/1986 small

According to Jim Snyder (written commun., January 1990): "According to Mike Brocchini, a National Park Service 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."

1986052701 Indian Canyon Arrowhead Spire RF Spring 5/27/1986 medium

(1) According to Steve Botti, National Park Service (oral commun., 27 May 1986): 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. (2) Source of the rock fall was a shear vertical cliff with a round circular shaped failure surface estimated [to be] 75 x 75 feet, with thickness uncertain. When rock hit slope below, the rock split into two directions.

1986052801 Indian Canyon Arrowhead Spire RF Spring 5/28/1986 small

According to Steve Botti, National Park Service (oral commun., 28 May 1986): A second rock fall from same area as the day before near Arrowhead Spire, although indications are that it was smaller than that of 27 May.

1987000001 Tenaya Canyon Quarter Domes RS n/a n/a/n/a/1987-1989 medium

According to Jim Snyder (written commun., 12 March 1998): "This rock fall [from Quarter Domes] was a small part of a continuing failure. Older failures at this point had produced some massive blocks. Some large rock falls had made the slope here a raw and open talus cone reaching to Tenaya Creek and

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actually forming the lower boundary of a small compartment along that creek. The large talus slope of big blocks shows clearly again on the 1970 edition of the Valley map. This talus is also underneath another intermittent creek which can carry notable flows off the open, slickrock cliffs above and a great deal of ice in the winter. The block that fell was perhaps 30 feet square and 5 feet thick, forming a part of the underpinnings for an arch from which larger blocks had fallen sometime past. The most recent block did not fall very far, hitting a bench which changed its direction to the center of the talus and breaking it up. Blocks 3 and 4 feet in diameter tumbled a relatively short distance down the slope. We could pick out the rocks from this particular slide because they were so relatively fresh, and yet, because they had already accumulated some lichen and showed some drainage marks, it is clear that the slide happened perhaps eight to ten years ago."

1987031001 Three Brothers Middle Brother RF Winter 3/10/1987 extremely large

According to Yosemite Association (1987) and Wieczorek et al. (1989): "At 2:47 p.m. PST on 10 March 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 10 March, 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 10 March, 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 disaggregated 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."

1987031002 Three Brothers Middle Brother RF Winter 3/10/1987 See ID 1987031001
See ID 1987031001

1987041201 Basket Dome Snow Creek Trail RF Spring 4/12/1987 medium

(1) According to Jim Snyder (written commun., January 1990): "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 source area 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 source area 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 6 April

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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and 14 April there was considerable snowmelt." (2) From Yosemite Association (1987): "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 leveled trees and other vegetation... In an area known as the "Tenaya zig zags", at least 28 switchbacks were covered, and many of those were destroyed completely. Though there is no sign of further instability on the cliffs above it, the trail has been closed and will remain so until a temporary trail can be completed. That should take 3 weeks or longer."

1987041601 Union Point Four Mile Trail RS Spring 4/16/1987 very small

According to Jim Snyder (written commun., January 1990): "A rock 5 x 3 x 3.5 feet came out of the bank into the Four Mile Trail seven switchbacks up from Union Point. Between 6 April and 14 April 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."

1987050201 Giant Staircase Nevada Fall RS Spring 5/2/1987 medium

According to Jim Snyder (written commun., January 1990): "According to Jim Snyder and Mike Shenton, on the Nevada Fall Trail, a rock slide occurred with a source area 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 30 April (0.47 inches[1.2 cm]), a slab 40 x 15 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."

1987060301 Basket Dome Snow Creek Trail RS Spring 6/3/1987 small

According to Jim Snyder (written commun., January 1990): "A slab 15 x 12 x 3 feet was blasted from above the 'Tenaya Zigzag' trail because the slab had been hit in the 12 April rock slide and would have likely fallen on the trail had it given way naturally."

1987081001 Three Brothers Middle Brother RF Summer 8/10-12/1987 small

According to Jim Snyder (written commun., January 1990): "On this day [10 August 1987] and for several days afterward the rock fall activity picked up significantly on Middle Brother, closing Northside Drive until Labor Day weekend."

1987081601 Taft Point n/a RF Summer 8/16/1987 small

From Middle Brother Rock-fall activity log, National Park Service (unpublished data, August 1987): "Not to be confused with any Middle Brother activity, there was a sizable rock fall and dust cloud at 1930 hours on south wall between Sentinel Rock and Higher Cathedral Rock".

1987090101 Basket Dome Mirror Lake Trail RF Summer 9/1/1987 large

According to Jim Snyder (written commun., January 1990): "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."

1987090102 Sentinel Rock Sentinel Rock RF Summer 9/1/1987 small

From Middle Brother Rock-fall activity log, National Park Service (unpublished data, September 1987): "several large rocks fell from high on Sentinel Rock," observed by Middle Brother rock-fall monitor.

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1987120001	Panorama Cliff	Panorama Cliff	RF	Fall	12/n/a/1987	very small
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According to Jim Snyder (written commun., January 1990): "A rock 3 x 2 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."

1988082301	Grizzly Peak	Vernal Fall	RF	Summer	8/23/1988	very small
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According to Jim Snyder (written commun., January 1990): "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."

1988091801	Half Dome	Porcelain Wall	RS	Summer	9/18/1988	very small
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(1) According to Jim Snyder (written commun., January 1990): "According to Jim Snyder and Mike Mayer, two slides occurred off Half Dome. At 1:40 p.m. 18 September 1988 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 source area (above and a little left) at 2:40 p.m." (2) According to Jim Snyder (written commun., 4 November 1992): "Snyder and Mayer were unable at the time to see how far the debris went."

1988091802	Half Dome	Half Dome	RF	Summer	9/18/1988	very small
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(1) According to Jim Snyder (written commun., January 1990): "According to Jim Snyder and Mike Mayer, at 4:15 p.m. 18 September 1988 a slab 2 feet thick and 10 feet square fell from below the 'Visor' at the summit of Half Dome, falling 2,000 feet." (2) According to Jim Snyder (written commun., 4 November 1992): "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."

1989000001	Union Point	Union Point	RF	Spring	n/a/n/a/1989	very small
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According to Jim Snyder (written commun., January 1990): "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."

1989000002	Cathedral Rocks	Lower Cathedral Rock	RF	n/a	n/a/n/a/1989	medium
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According to Jim Snyder (written commun., 25 February 1992): According to Don Reid 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."

1989012101	Merced River Gorge	Big Oak Flat Road	RS	Winter	1/21-28/1989	very small
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According to Jim Snyder (written commun., January 1990): "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."

1989021401	Merced River Gorge	Big Oak Flat Road	RF	Winter	2/14/1989	medium
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According to Jim Snyder (written commun., January 1990): "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,

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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 source area 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 live oak, 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."

1989030501 Half Dome Mirror Lake Trail DF Winter 3/5/1989 medium

According to Jim Snyder (written commun., January 1990): "During a heavy, high elevation rainstorm late this night, Curry Stables employees 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."

1989031501 Hetch Hetchy Tueeulala Falls RS Winter 3/15/1989 small

According to Jim Snyder (written commun., January 1990): "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 live oak, bay laurel, manzanita, and cedar."

1989032901 Sentinel Rock Sentinel Rock RS Spring 3/29/1989 very small

According to Jim Snyder (written commun., January 1990): "A rock slide was observed by visitors beneath Sentinel Rock, though no evidence of rock debris on the Four Mile Trail could be located, according to Jim Snyder and Ron Mackie."

1989040001 Panorama Cliff Panorama Cliff RF Spring 4/n/a/1989 medium

According to Jim Snyder (written commun., January 1990): "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."

1989072501 Three Brothers Middle Brother RF Summer 7/25/1989 very small

According to Jim Snyder (written commun., January 1990): "A small flake fell from the massive face below 'Michael's Ledge' on 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 10 March 1987 and later."

1990042301 North Dome/Washington Column Mirror Lake Trail RF Spring 4/23/1990 very small

According to Jim Snyder (written commun., 24 April 1990): "In the early morning hours on Monday, 23 April 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 [rock-fall source area] was not the same as the 1 September 1987, rock fall which did more damage to the trail and which sourced much more material... The 23 April fall came from a weathered jumble of rock along an intermittent cliff face drainage channel down and east of the 1987 source area. 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, 25 April, for reopening 26 April ..."

1990100001 Glacier Point Glacier Point Apron RF Fall 10/n/a/1990 small

(1) According to Jim Snyder (written commun., 25 February 1992): "According to Don Reid 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." [This rock fall could possibly have been associated with the 23 October 1990 earthquake described in IDs 1990102301-1990102304] (2) From Google Groups, rec.climbing, report by rock climber Ben Harmon: "I was on that same route [The Grack, Center] a few years ago when we had an exciting experience with a rock fall. Far above us, from the very top of the point, some refrigerator sized rocks fell silently through the slanting morning sunlight. My friend saw them first. He was leading and called down to us to "watch out!". Well, you know the route, no place to hide, besides they were falling far off to the side, so I watched as they fell. They seemed to fall rather strangely slowly, turning over in the air, still no sound. Then they struck the top of the slanting apron and immediately exploded, sending fragments in a 180 degree arc. The shrapnel seemed to suddenly accelerate to phenomenal speeds. Even though the contact point was hundreds of yards sideways and above us, I barely had time to throw my back flat against the rock before a piece of stone the size of a garbage can lid skimmed about six inches over me. It was like a scene straight out of 'Star Wars' as the piece skimmed like a fighter jet down the rest of the apron, maintaining its improbably close proximity to the rock face until it hit the bottom with a crash."

1990102301 Merced River Gorge Big Oak Flat Road RS Fall 10/23/1990 large

(1) From the Escondido Times Advocate (1990): "'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. " (2) According to Tim Ludington, National Park Service, (oral commun., 22 July 1991): 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. (3) From National Park Service Maintenance Management, Location Maintenance Report, Earthquake Damage, Hwy 120 (unpub. data, 22 July 1991): Total cost of removing rocks on Highway 120 from the October 1990 earthquake was \$11,849 (390 hours). 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. (4) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M5.2 occurred near Lee Vining, California, about 50 km east of Yosemite Valley.

1990102302 Merced River Gorge El Portal Road RS Fall 10/23/1990 small

(1) From the Escondido Times Advocate (1990): "A rock slide just half a mile away closed Highway 140 into the Park, but that was expected to be cleaned up today ..." (2) According to Tim Ludington, National Park Service, (oral commun., 22 July 1991): Rocks stopped on Highway 140 where there is a pullout on river side of road. (3) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M5.2 occurred near Lee Vining, California, about 50 km east of Yosemite Valley.

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1990102303 Indian Canyon Indian Canyon RF Fall 10/23/1990 small

(1) According to Jim Snyder (written commun., 21 May 1991): "I [Snyder] was sleeping nearby at the time and heard rocks falling in Indian Canyon during the earthquake. The following morning I was not able to locate the source area(s)." (2) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M5.2 occurred near Lee Vining, California, about 50 km east of Yosemite Valley.

1990102304 Tioga Pass Lee Vining Canyon RS Fall 10/23/1990 small

(1) From the Escondido Times Advocate (1990): "State highway crews were also cleaning up a slide on Highway 120 on the east side of the park [due to the earthquake]." (2) From U.S. Geological Survey, National Earthquake Information Center (2004): An earthquake of M5.2 occurred near Lee Vining, California, about 50 km east of Yosemite Valley.

1991000001 Merced River Gorge Rostrum/Elephant Rock DSL Winter n/a/n/a/1991-1992 medium

From Jim Snyder (written commun., 25 February 1992): "According to Don Reid 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."

1992020001 El Capitan Southeast Face RF Winter 2/n/a/1992 medium

According to Park Geologist Greg Stock: Rock climbers Eric Kohl and Cade Lloyd witnessed a rock fall from southeast face of El Capitan. The rock fall originated from about 250 m up the southeast face, on the climbing route "Surgeon General"; Kohl reports that the rock fall removed the "Chandelier Pitch" (the 8th pitch) of that route.

1992021801 Three Brothers Middle Brother RF Winter 2/18/1992 medium

From Jim Snyder (written commun., 25 February 1992): "On 18 February 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 as 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 10 March 1987. Northside Drive was closed to traffic awaiting the consequences of the next Pacific storm and reopened on 24 February. Along the top ridge of Middle Brother, a column of massive granite roughly 20-foot square and perhaps 3 to 5 feet thick had sourced. 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 19 February water was observed draining from fractures on the steep face and was believed instrumental in triggering the failure. Although little rain had fallen on 17 February, 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."

1992071401 Royal Arches Royal Arches Cascade DF Summer 7/14/1992 large

(1) According to National Park Service Physical Scientist Louise Johnson (written commun., 19 August 1992): "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 14 July 1992. 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

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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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." (2) According to Jim Snyder (written commun.): "The debris flow initiated in the 195-acre area burned by the 21 June 1992 Dome Fire, west of North Dome. There were reports of some debris starting to come down on the afternoon and evening of 12 July. At the Yosemite Valley Fire House, about 1.4 km west, rainfall on 12 July amounted to 1.33 inches [3.4 cm] during a 22-hour period and was 0.35 inches [0.9 cm] within a 1-hour period on 14 July. Hydrophobic materials were found in the medium-coarse sandy deposits in the parking lot."

1992072401 Yosemite Falls Yosemite Point RF Summer 7/24/1992 large

According to Robert Reece (oral commun., 24 August 1992): A large rock fall, about the size of a house, broke loose from Yosemite Point on 24 July 1992 at 6:05 am. Reece 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.

1993030001 El Capitan Southeast Face RF Winter 3/n/a/1993 large

According to Park Geologist Greg Stock: Climber Eric Kohl reported a large rock fall in the vicinity of "El Capitan Tree", a large ponderosa pine growing on a ledge about 120 m above the base of the southeast face of El Capitan, in which pitches 2 through 6 of the climbing route "Atlantic Ocean Wall" fell off.

1995010001 Tenaya Canyon Quarter Domes RS Winter 1/n/a/1995-1996 very small

According to Jim Snyder (written commun., 12 March 1998): "This [rock] slide came from the face of a buttress across from Watkins Pinnacle and below the Quarter Domes of Clouds Rest. It consisted of several small blocks, probably no more than three or four cubic yards altogether, that came from a joint or lens of less cohesive, erodible granitic rock. The source area is a small joint and roof seasonally affected by drainage of water and ice on the north facing slope below the Quarter Domes. We could not see the source area as clearly as we would have liked, but we could see its location and some of the fresh source as well as the impact area. The source area lies at about 5,600 feet elevation. The rock fell about 300 feet into a talus area subject to frequent enough rock fall that it even shows as an open area on the Yosemite Valley topographic map. The fragments we saw were no larger than 30 inches, often half that. They were fresh, without any lichen or drainage marks or moss, indicating that it had fallen within the last year or two. Impact points had been weathered slightly, and the rock had settled, as had the smaller material that had come with it. There was also some vegetation around the new rocks which had sprung up since the rock fall, probably as the flowers of last summer."

1995031601 Merced River Gorge El Portal Road / Windy Point RF Winter 3/16/1995 small

According to Jim Snyder (oral commun., 16 March 1995). Rock fall along Highway 140 below Windy Point but above Dog Rock. One big rock took out the road, but not the sewer or water lines.

1996010001 Basket Dome Basket Dome RF Winter - Spring 1-4/n/a/1996 very large

According to Jim Snyder (written commun., 12 March 1998, and revised 27 January 2011): "The Basket Dome rock fall did not hit the Mirror Lake loop trail as the Mirror Lake rock fall (ID 1996111701) had in November 1996, and was consequently unreported at the time of its collapse. It is fairly new, however, showing up in July 1996, photographs from the talus cone of the Happy Isles rock slide. No lichen or moss or marks of drainage have formed on the fallen blocks, nor has any vegetation grown up among them. The broken trees have still enough freshness about them to conclude the slide occurred late winter or early spring, 1996. It occurred at a time when few people were on the Mirror Lake loop,

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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probably during a storm, for the thunder from this rock fall would certainly otherwise have been reported. Like the Happy Isles rock slide, this one consisted of a long arched slab on a face of more massive granite which had been subject to periodic peeling for long enough that the talus cone below reached out underneath the trail to Tenaya Creek itself. The failed slab was, to judge from weathering lines along the edges, about 500 ft. long and 200 ft. high. Its thickness was probably 10 to 20 feet. Though composed of Half Dome Granodiorite, the rock at the source area was both massive and more finely jointed than surrounding rock. At the top of the source area, trees and other vegetation had sent roots well down behind and into the failed slab. There is a strata of more finely jointed rock running east to west through the cliff approximately a third of the way down from the top of the source area. This weakness, with the penetration by roots, may have contributed to the eventual failure. The source area lies between 5,360 and 5,560 feet elevation, some 600-700 feet west of the creek running down from Basket Dome. A clear bench above the source area has a thick woods of canyon live oak with scattered pines. When it fell, the slab probably broke up immediately, as thin as it was, but it dropped, slid, and dropped further before reaching the talus. Its velocity carried blocks about 600 feet down the talus slope into the woods just above the trail. The woods there of oak, fir, cedar, and pine were simply obliterated. The foot of the talus from this fall is a kind of topographic step formed of jumbled blocks each of 10-15 feet diameter. Despite intervening storms and heavy rains, dust and smaller grain material left from the collapse lies in many crevices and depressions in the slide."

1996051601 Glacier Point Happy Isles DF Spring 5/16/1996 small

According to Jim Snyder (written commun., 27 January 2011): "Rainfall generating the 16 May 1996 Happy Isles debris flow recorded in historical data show 0.44 inches [1.1 cm] occurring on 15 May, 2.20 inches [5.6 cm] occurring on 16 May, and 0.50 inches [1.3 cm] occurring on 17 May 1996. The debris flow occurred on 16 May, burying a perhaps 40 yard stretch of the horse trail and the area surrounding it behind the Nature Center in a foot or more of mud. National Park Service Trails attempted to channel the mud off the trail by opening up buried but existing drains along and across the trail and by clearing some of the small incoming channels uphill through the then-wooded talus. This wooded area and the trail were subsequently obliterated on 10 July 1996 by the Happy Isles rock fall."

1996071001 Glacier Point Happy Isles RS/RF Summer 7/10/1996 very large

(1) From Snyder (1996) and Wiczorek et al. (2000): At 17:52 PST on 10 July 1996 two rock falls only seconds apart occurred near Happy Isles in the Yosemite Valley (blocks A and B) without any apparent triggering event. From a developing arch-like cliff between Washburn and Glacier Point several hundred meters above the Tioga glacial trim line, the rock masses started sliding along a steeply inclined plane. Traveling down this plane their horizontal velocity was sufficient to launch the falling masses, which cleared the base of the cliff and hit the talus 500 m below. The first mass (block A) was estimated to be 15%-20% the size of the second (block B); together the two masses amounted to a volume of between 23 and 38 thousand cubic meters. The two rock falls hit the talus slope 13.6 seconds apart; their separate impacts were recorded by seismographic stations in western Nevada and central California. The impacts of these large, still largely intact rock masses (blocks A and B) onto the talus slope generated an air blast that traveled well beyond the limit of fresh rock on the talus slope and knocked down or snapped 1000 trees that damaged the Happy Isles Nature Center, destroyed a snack bar, killed one person, and seriously injured several other people in the vicinity of Happy Isles. Shortly following the air blast, a rapidly moving cloud including coarse sand and finer particles was generated from the impact that enveloped the area of the Nature Center and Happy Isles in a thick cloud of dust that for several minutes blocked out the early evening sunlight. Later that evening and early the next morning two additional large pieces of rock from the southern section of the cliff broke loose and followed an alternate path down a chute that added to the upper southern part of the talus. Bouncing and breaking

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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up along this path, these masses did not reach the talus as large intact pieces and there was no large air blast as with the two earlier rock falls. Smaller pieces of the arch fell later that evening (block C) and early the next morning (block D). These blocks from the southern, thinner end of the arch took a different path than blocks A and B that had fallen earlier. Instead of sliding on the ramp and then free falling, blocks C and D disaggregated as they followed a chute to the southeast that funneled onto the apex of the previous talus cone. Smaller pieces of the arch continued to collapse, slide, and fall during the following days and weeks, continuing until at least early August. (2) From Mark Grossi in The Fresno Bee (3 November 1999): The concussion knocked down huge trees, which crushed and killed Emiliano Morales, 20, of Montebello, who was standing near an ice cream stand. Fourteen other people were injured: one woman was left paralyzed. (3) According to Dick Ewert (oral commun., March 2012): At the time of the rock fall Ranger Dick Ewert was at his residence at Glacier Point when he felt a slight shaking. Immediately thereafter he heard a roaring sound that he described as a squadron of jet fighters flying low overhead. He was unaware of the source of the noise and shaking until about twenty minutes later, when he realized the view of Half Dome from Glacier Point was obscured by dust. (4) Watts et al. (2007) and Watters et al. (2007) hypothesized that the 1996 Happy Isles rock fall was triggered by leachate discharged from a leachfield located upslope of the rock-fall source area; this hypothesis was evaluated by Stock et al. (2012) and shown to be highly unlikely based on the frequency of rock falls from Glacier Point and the vastly larger quantities of water produced by local snowmelt.

1996071002	Glacier Point	Happy Isles	RS/RF	Summer	7/10/1996	very large
See ID 1996071001 Block B						

1996071101	Glacier Point	Happy Isles	RS/RF	Summer	7/11/1996	large
(1) See ID 1996071001 Block C. (2) The combined volume of Blocks C and D is 4, 900 cubic yards [about 3,750 m ³].						

1996071102	Glacier Point	Happy Isles	RS/RF	Summer	7/11/1996	See ID 1996071101
See ID 1996071001 Block D.						

1996090101	Yosemite Falls	Yosemite Falls Trail	RF	Summer	9/1/1996	small
(1) From web site http://www.yosemite.org/halfdome (15 September 1996): A large rock fall occurred just west of Columbia Point on the trail to the top of Yosemite Falls at roughly 09:30, 1 September 1996. Early reports say about 200 feet of rock fell off the northern slope of Yosemite Valley, making the Yosemite Falls trail impassible. Search and rescue crews, complete with a canine unit and helicopters, searched the area this afternoon for hikers who may have been caught in the rock fall. No fatalities have been reported, and no one has been called in missing. The rock fall has caused the National Park Service to close the 3.7-mile trail to the top of Yosemite Falls for a short time after the fall, but the trail is now open again. (2) From the San Francisco Chronicle (2 September 1996): "A rockslide along the Upper Yosemite Falls trail in Yosemite National Park yesterday forced the closure of the popular route during the height of the Labor Day weekend. Park ranger Susan Gonshor said the slide was 'quite small' by Sierra rock fall standards. It occurred at about 9:45 a.m., sending a cascade of rocks and trees onto the trail about 1,000 feet up from the Yosemite Valley floor. The incident apparently caused no casualties, Gonshor said. 'We will be searching the slide with a dog team and trail crews once the stability of the area has been assured,' said Gonshor. 'There is still some loose material between the release point and the trail. So far, we have no reports of injuries or missing hikers.' Gonshor said the trail will remain closed for at least a day. 'The crews have to clean the debris off, but they should be able to do it by hand,' she said. 'Most of the rocks weren't any bigger than three feet across, and the trees were only about six or eight inches in diameter.'" (3) According to Jim Snyder (field notes, 1						

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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September 1996): This rock fall was reported from the same source as ID 1973060001. Two hundred feet of trail were hit, but not severely damaged; [there was] one large rock of 3-4 feet.

1996111701 Basket Dome Mirror Lake Trail RF Fall 11/17/1996 large

According to Jim Snyder (written commun., 12 March 1998): "The first rock slide hit the trail around the north side of Mirror Lake with large blocks. At least two other rock slides have occurred in recent years in this vicinity (IDs 1987041201, 1990042301). The newest slide came from a shelf perhaps 300 feet above the trail, where part of a thick slab had sat on a steeply inclined plane. Breakage at the east end of the slab had apparently been accelerated by intrusion of tree roots, but the majority of the thick, clean break at the source area showed no roots. The block that fell was approximately 150 feet long, 25 feet high, and 30 feet thick. The block sat on a bedrock plane inclined at about 40 degrees. The block fell at 16:00 on 17 November 1996, making enough noise to be heard and reported by employees and visitors in Yosemite Valley. The block fell a short distance, slid down a broad inclined plane, then fell again, breaking up as it went down to leave a clutter of large blocks on the slope and trail, reaching the edge of Mirror Lake. As the block fell, it broke off a couple smaller slabs. One was 3 ft. thick, 10 ft. wide, and about 25 ft. long, part of a climbing route just above the top of the talus. This slab, broken by impact, simply slid intact the few feet to the top of the talus. On 17 November 1996, a total of 3.7 inches [9.4 cm] of rain fell in Yosemite Valley followed by 2.6 inches [6.6 cm] the following day, the first of a series of fairly heavy storms which built up the snowpack and began the process of soil saturation preceding the 1 January 1997 flood."

1996123001 Glacier Point Happy Isles DF Winter 12/30-1/1996-1997 very large

According to Jim Snyder (written commun., 12 March 1998): "The largest debris flow [generated by the 1 January 1997 storm] occurred at Happy Isles. While this flow occurred during the flood storm, the flow was anticipated by the unusual rock fall of 10-11 July 1996. That rock fall left new elements on the topography. Where the largest blocks hit, disintegrating on impact, they left high mounds of loose, unconsolidated material. When saturated and mixed with rapidly flowing water, parts of the mounds gave way, flowing out toward the fen, burying about two acres and much of the vegetation knocked down by the July rock fall up to ten feet deep. The small Happy Isles power house was buried three to four feet deep in 6 inches - rock and sand. The upper springhouse from 1912 was overtopped and buried, as were some remaining sections of the old trail with its walls and culverts in that area. The topography was altered yet again, as the sharp toe of earlier slides and debris flows creating a six to ten-foot elevation drop in the fen was smoothed, given a gentle, even gradient by the new flow of material from the rock fall. Traditional channels for water were changed, as were underground springs. In the debris flow were many springs, whose the water had a strong smell, a little like sewage, with a brown color and rapidly growing fungus. This must have been from the vegetation ground up by the slide, leaching out and rotting. The burial of more vegetation by the flow may have increased this process, for there was more water and much more discoloration in February than during the months following the rock fall last July. By the end of March the water was beginning to clear. ... There are still shoals of gravel here. Sand was carried all the way down to the boardwalk where it is several inches deep behind that structure. But this point, 675 feet, is sort of the end of the continuous spreading flow. Farther down, material was carried by water along an existing channel. There is about ten feet of relief in front of the old debris flow lobe at the edge of the spring boxes and the edge of the trail as measured in areas kept free of debris flows by trees fallen during the airblast. The debris flow is about 200 feet across at its widest point, but there is great variation in width because of the damming and redirecting of material by airblasted trees."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1996123002	Merced River Gorge	Big Oak Flat Road	ESL	Winter	12/30-1/1996-1997	small
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According to Jim Snyder (written commun., 12 March 1998): On the Big Oak Flat Road there were several slumps of saturated soil in the vicinity of the chain control pullout and what is called "Rattlesnake Spring." There had been some smaller slope failures in this vicinity earlier, probably the result of ongoing adjustments of the slope to the road cut in deeper soils and decomposing bedrock. The Forest fire of 1990 stripped vegetation from the slope, defining the preconditions for the slumps during the last flood storm.

1996123003	Merced River Gorge	Big Oak Flat Road	RF	Winter	12/30-1/1996-1997	small
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According to Jim Snyder (written commun., 12 March 1998): "Also on the Big Oak Flat Road the parapet wall was knocked out by rock fall down a steep, rocky drainage channel at the east end of the second tunnel on the road some time before the flood. During the flood, rock fall took out a similar section of parapet wall on the west end of the same tunnel, and another section around the turn roughly 800 feet east of Cascade Creek bridge. The rock near the tunnel seems to have come down a drainage above the west end of the tunnel, while the other rock came down a steep, rocky cliff over the road around from Cascade Creek. Quantities of rock fall in these locations are unknown, as are the exact source areas."

1996123004	Wawona Road	Grouse Creek	ESL	Winter	12/30-1/1996-1997	large
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According to Jim Snyder (written commun., 12 March 1998): "On the Wawona Road at Grouse Creek was a continuing earth slump. Six to eight feet thick, saturated, iron-rich soils slumped along decomposed bedrock forming a slip joint along which water flowed. This was not the first movement in this particular slump. I recall some trees down from minor slumping at this point in the in the storms of March, 1986. The present slump opened up in its most recent form about spring, 1995, after which the rock wall was begun in it to shore up remaining material. During the flood, more saturated soils collapsed from the headwall of the slump to flow over the new wall and across the road. Drainage from the slump gullied the downhill side of the road and deeply gullied a part of the old Wawona Road below. There is a long history of problems with the Wawona Road in this stretch. Problems began as the road was being built. Problems at Grouse Creek began during construction in 1932 with slides coming out of new road cuts in the wet spring months. Heavy storms in April 1935, caused more slumping in roadcuts along the road. Slumping at Grouse Creek was continual during March and April 1936, when 17 men were kept working removing material and shoring up the cut banks. A rock wall was built at this slump, using rock pulled down from retaining walls on the Old Wawona Road. The wall is partly overgrown now but stabilized this slump at the time. In the flood of 1937 Grouse Creek took out the entire road, leaving a 20-foot-deep channel through the relatively new fills. The road crossing of Grouse Creek was washed out again in the 1955 flood, leaving a crater 40 feet across and 20 feet deep."

1996123005	Giant Staircase	Vernal Fall	RS	Winter	12/30-1/1996-1997	very small
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According to Jim Snyder (written commun., 12 March 1998): "The flood storm in 1997 brought only a couple of rocks onto the Vernal Falls Trail. One rock, 4 x 4 x 3 feet, came from the base of the cliff perhaps 100' up the talus from the trail just below the 1986 rock slides [IDs 1986020701, 1986021301, and 1986030801] which were at Anderson's trail below the Vernal Falls bridge. The rock came down through live oaks over well-soiled talus to land on the trail with a small quantity of smaller rock."

1996123006	Giant Staircase	Nevada Fall	RS	Winter	12/30-1/1996-1997	very small
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According to Jim Snyder (written commun., 12 March 1998): "A second rock, 3 x 3 x 2 feet, fell off the inside bank of the trail at the junction of the horse trail with the foot trail, just under a remnant of the old Hutchings trail."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1996123007	Indian Canyon	Indian Canyon	RS	Winter	12/30-1/1996-1997	very small
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According to Jim Snyder (written commun., March 12, 1998): "A slide was reported in Indian Canyon during the flood. Residents living under Indian Canyon heard it clearly but the clouds and rain were too thick to see through. We examined the slopes of Indian Canyon but were unable to locate any new source area that would correspond to the flood generated slide. Indian Canyon is a hard place to look because it has so many joints, overlays, castellated cliffs and other obscuring formations. Knowing other scars there from previous slides, we can only conclude that this slide, while noisy, was not very large and came from a smaller, even hidden source area."

1996123008	Sentinel Rock	Sentinel Creek	DF	Winter	12/30-1/1996-1997	large
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According to Jim Snyder (written commun., 12 March 1998): "[Sentinel] Creek with its material ran very high in the January flood and had great power of movement in its narrowest parts with greatest gradient. Impact marks on older rocks well up the bank show large rocks moving at fast speeds. Rocks in the streambed were hit, scraped, gouged, shorn of older patinas and rough edges. There was a little channel cutting just below the falls, but the cutting there was controlled in part by two large rocks at the head of the channel's first turn. The real cutting started just below this first turn with the two large blocks forming a gully head. Banks had collapsed in this area before. At this first turn this time the creek picked up additional loads, probably more suddenly than gradually. This material in turn helped cut into the steepest banks to bring more material into the stream. The greatest deposition occurred at the mouth of the gorge where the water was suddenly not confined. New material dumped there amounted to about 2,100 cubic yards. There was probably a time sequence in the way this happened. The historic channel was quite shallow at the top of the alluvial fan, the creek barely making the sharp turn at the gorge mouth. But a lot of water moved down the straighter 1983-1986 channel too. There was not as much material this time as in 1983, and the material contained more fines. In 1983 there were large boulders up to five feet in diameter on the trail across this new branch and deep (three feet or more) accumulations of 18-inch-cobbles and fines. There was some material on the trail from 1997 but the trail remained mostly visible, while the west end of it suffered a small washout rather than burial by new material. It appears that Sentinel Creek first jumped the low barrier from 1986 to go down the straight channel. It was carrying much water from the storms but less load. It probably began depositing at the mouth of the gorge early, but the presence of large rocks and gradation of the deposition pile in a talus-like fashion from larger to smaller rocks seems to indicate a more sudden event. Channel wall collapse greatly increased the load and volume of the creek with quick deposition at the gorge mouth. Even with that deposition, the creek overtopped the pile for a time and carried fines down the straighter channel toward the road. But deposition also forced the creek to turn east, where it rejected its historic channel and braided its way to the road beyond the historic and the 1983 channel. Much of the volume ran under the original road crossing anyway. In this stretch of new channel cutting and braiding down the fan, the creek picked up and moved more material from new sources, carrying it a little ways down the new channels until gradient and obstacles forced deposition, leaving fines to be carried to road and river. The quick deposition of large material at the mouth of the gorge of Sentinel Creek was the main reason there was less road impact in 1997 than there was from earlier storms. In 1997 the material came from the bank sides along the approximately 1,000 foot long gorge. In earlier events material had come from much higher elevations, in turn loosening material in the bank walls of the gorge. Much of that 'new' 1983 material continues in evidence in the fresh white rock of the straight channel between the gorge mouth and the bridle path."

1997000001	Tenaya Canyon	Quarter Domes	RF	n/a	n/a/n/a/1997	large
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(1) From Reid (1998): "Immediately right of pitches 4-7 [of the climbing route Pegasus], a rock fall occurring in 1997 appears to have showered debris on the lower portion of this route." (2) Report on

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Google Groups, rec.climbing, by rock climber Irving J. Oppenheim: "We did the regular route on East Quarter Dome in 1996... A few months after our ascent there was major rock fall to the right of the route, and we saw the obvious scar in subsequent seasons... I recall a trip report on rec.climbing from someone who did the route shortly after the rock fall. He reported that the fall was to the right of the route itself, but that cracks were choked and ledges were covered with pebbles from the rock fall."

1997010001 El Capitan Southeast Face RF Winter 1/n/a/1997 large

According to rock climber Bryan Law, a rock fall occurred from the southeast face of El Capitan, from the 8th pitch of the climbing route "Space", approximately 200 m above the base of the cliff. The resulting scar is about 50 m tall and 12 m wide at its widest point. Reports from other climbers indicate that the entire 8th pitch of the route is now missing. Law reported that "fresh talus and mangled oak trees were covered with a ton of rock dust for at least a few months after the event and there were a bunch of impact marks on the slabs below The Alcove where the blocks first impacted."

1997010101 Sentinel Rock Sentinel Creek RS Winter 1/1/1997 small

According to Jim Snyder (written commun., 12 March 1998): "There was a small rock slide down the channel just west of Sentinel Creek between 11 a.m. and noon PST on 1 January 1997, observed by David Lugar of the Yosemite Post Office. Rock fell for about 80 seconds with one large impact and smaller ones before and after. Clouds greatly limited visibility, but later observation of the talus cone at the foot of this channel and freshly exposed soils in a scar near earlier source areas up the cliff near 6,600 feet showed the location more clearly."

1997010201 Glacier Point Staircase Falls RS Winter 1/2/1997 very small

(1) According to Jim Snyder (written commun., 12 March 1998): "A small rock slide occurred at Staircase Falls in the evening of 2 January 1997. Part of Staircase had flowed black with mud during the day. It brought new alluvium to the small fan at the cliff base and washed material around some of the cabins and out into Camp Curry. The material-laden fall may have been precursor, even initiator, of the small rock slide later in the evening. One rock about six inches diameter hit the roof of Camp Curry cabin 72B, and the occupants of cabins 72 and 73 were evacuated in case there were any more to come. The rock on the roof was a fragment cracked off and sent flying in the collision of a couple of blocks farther up the hill from the cabins. There is a relatively small talus slope below Staircase Fall. The new rock stands out, as do the trees it hit and scraped. The new rocks were on the west side of the creek and scattered over about a hundred feet behind a large block marking the fall line to the rear of cabins 72 and 73. The new rocks were roughly 4 x 3 x 3 feet and 3 x 1.5 x 1.5 feet. There were also four 1.5 feet square blocks and a 30 inch square block. [Note: concessionaire security staff member Dave Marino witnessed one of these smaller blocks strike a tree and land on the snow-covered ground. He clearly heard a hissing sound as the rock melted into the snow, producing steam. This indicates that the rock was extremely hot, presumably due to frictional heating associated with impacts/fragmentation along the fall path]. We could see a fresh small scar at about 4,800 ft., just right of the fall in a cliff face which receives a lot of water and forms ice. The rocks bounced and slid down the face to hit the talus slope, from which they bounded down, leaving impact depression, scars and broken trees. The source of the rock appears to have been a pocket of less massive, more fractured and weathered rock from which this has not been the first failure. While there had been ice associated with this location, it was obviously the heavier flood-producing rains that generated this particular rock fall." (2) According to the Superintendent Monthly Report (January 1938): A much larger slide and debris flow invading several Camp Curry cabins occurred in the 1937 flood [ID 1937120901].

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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1997060001	Cathedral Rocks	Middle Cathedral Rock	RF	Summer	6/20-27/1997	very small
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According to Chris Falkenstein (written commun., Google Groups, rec.climbing): Several rock falls occurred from Middle Cathedral Rock. Falkenstein reported that rock falls had been occurring on the route 'Central Pillar of Frenzy' on Middle Cathedral "all week."

1997062501	Cathedral Rocks	Middle Cathedral Rock	RF	Summer	6/25/1997	small
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According to David Hill (written commun., Google Groups, rec.climbing): A rock fall occurred from the north face of Middle Cathedral Rock. Hill had just topped out on the Muir Wall route on El Capitan, when "not five minutes later, we heard this incredible roar... looking over, we saw this massive rock fall come off of the upper portion of the north face of Middle [Cathedral Rock]. Seconds later, it exploded all over the north apron."

1997091401	Giant Staircase	Liberty Cap	RS	Summer	9/14/1997	small
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From National Park Service Division of Ranger Activities (unpub. report, 17 September 1997): "A rock slide on the Mist trail near the top of Nevada Falls on September 14th resulted in a serious head injury to a visitor. Although the trail was crowded with hikers at the time, the only person injured was a 63-year-old man who was trapped for about 15 minutes under a tree which came down in the slide. Bystanders were able to lift the tree off him prior to the arrival of rescuers. Because of high winds blowing at the time, a helicopter short haul evacuation was not possible. Rangers and SAR team members had to carry him by litter about a mile to a landing zone, where he was picked up by helicopter, flown to Yosemite Valley, and transferred to a medical helicopter that took him to a hospital in Modesto. Over 40 people were involved in the rescue. [Brian Smith, SPR, YOSE, 16 September 1997]"

1997092001	Yosemite Falls	Sunnyside Bench	RF	Summer	9/20/1997	small
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According to Google Groups, rec.climbing (written commun.): A rock fall occurred near Sunnyside Bench. The reporting party was hiking near the Five Open Books west of Lower Yosemite Falls and heard a "very large rock fall".

1998000002	Tenaya Lake	Tenaya Lake	RF	Winter	n/a/n/a/1998-1999	small
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From Barnes et al. (2003), p. 53: "[The climbing route] Blues Riff [on Phobos-Deimos Cliff] is one of the best crack climbs in Tuolumne. In the winter of 1998-1999 a gigantic block forming one wall of the first pitch 5.10 offwidth fell off, but an alternate face climbing variation was established soon thereafter."

1998041701	Glacier Point	Happy Isles	RF	Spring	4/17/1998	small
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According to Jim Snyder (written commun. 21 April 1998): "On Friday, 17 April 1998, at 10:01 a.m., Jack Phinney heard a loud snap. He was standing outside the Nature Center (Happy Isles) and looked up to see a number of boulders falling from the 10 July 1996 source area. There was no wind, so the dust track of the rock slide lasted for some time. He felt the source might have been down 50-100 feet from the source area based on the dust track, but was not sure. He said there were a number of large boulders (he thought might be a little over 10 feet in diameter) cascading down the cliff in the traditional fall line or drainage to the top of the talus slope. He could not tell if they hit the projecting buttress above the top of the talus cone first, but thought they bounded around it. The largest rock hit the talus slope, well out from the cliff face, and hit it hard enough that it sent other large rocks from the talus slope flying into the air. ... The rock slide sounded small enough that locating a source might be difficult, especially if it came from the south side of the older source. It does not sound like there was enough impact to the projecting buttress to enlarge the crack through it generated by the 1996 rock fall, but it may still be worth checking. Without a previous measurement, it would probably be impossible to tell of any change. Jack was very clear about the initial sound, which was a snap or pop rather than the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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sound of impact. So it seems clear this was a new rock fall rather than something more off the ledges somewhere, or the falling of something that had already been cracked off."

1998060601 Glacier Point Happy Isles RF Spring 6/6/1998 small

According to Jim Snyder (written commun. 7 June 1998): "There were two small rock slides from the source area of the 1996 Happy Isles slide. They were small but raised a considerable plume of dust in going down the cliff and hitting the talus at the bottom. There are a couple streams of water coming down the cliff too, and these seem to be related to the rock slides. One of them was on the south end of the source area, just below a large pine which has roots sticking out of the cliff. ... there was a big jeffrey on a ledge, the largest tree along the top of the source area. ... The other rock fall, from the tree source, came down the chute to the talus cone. These two slides occurred between noon and 12:30 p.m. PDT, 6 June 1998 (Monday)."

1998060602 Glacier Point Happy Isles RF Spring 6/6/1998 small

According to Jim Snyder (written commun. 7 June 1998): "The other slide was on the south edge of the more massive block B, where the rock becomes more fractured and decomposed because the largest stream of water comes through that area. The rock from this latter slide went down the face to hit near the base of the cliff between the Block B hill and the foot of the talus cone. The rock was little stuff pretty much pulverized in the process."

1998080001 El Capitan Southeast Face RF Summer 8/n/a/1998 very small

According to Bryan Law (written commun., May 2012): "We witnessed a small rock fall in the early morning on one of the first few days of August, 1998, while on route on the right side of El Capitan (first ascent of [the climbing route] 'Ned's Excellent Adventure'). The rock fall consisted of 3 to 5 microwave to mini-fridge sized blocks that appeared to originate from near or at the top of the wall, just west of [the climbing route] Zodiac. There were some climbers bivied at the base of Zodiac who got a bit of a rude awakening, but no one was hurt. This was probably between 6:30 and 7:30 in the morning as we were still in the portledge. The sound of the blocks in flight was really loud and it looked like they never touched the wall and then impacted in the talus."

1998111601 Glacier Point Curry Village RF Fall 11/16/1998 large

(1) From Wieczorek and Snyder (1999): "A series of rock falls from an elevation of about 5,500 feet on the north-facing wall of Glacier Point threatened employees and visitors to Camp Curry. No previous historic rock falls have been recorded from this source area. The source area is slightly above the glacial trim line of Matthes (1930) for the Tioga glaciation and these rocks have been exposed to weathering for more than the last 1 million years. The arch-like rock mass involved in this rock-fall event was composed of granodioritic and tonalitic rocks from a unit included in the Sentinel Granodiorite by Calkins (in Matthes, 1930) [later mapped as the granodiorite of Glacier Point by D.L. Peck (2002)]... The first rock fall in a sequence from the location above Curry Village occurred on 16 November 1998 and had a volume of about 736 yards³ [563 m³] (1738 tons). The block(s) fell 100-150 feet down the steep (75°) cliff face to ledge, breaking up against the cliff. From there the rock fell another 950 feet, breaking up more before hitting the top of the talus. The size and velocity of the rocks were sufficient to knock over and clear many large trees from the upper part of the talus. The rocks continued to bounce, roll, and slide down the talus, their paths determined in part by the distribution of larger boulders from prehistoric rock falls and large trees which either stopped or directed their paths. The rocks that travelled farthest, about 1,600 feet from the top of the talus, took a northeasterly direction. Large rocks reached within about 75 feet of the closest tent cabin (Tent 29), highest on the talus. Smaller, mostly fist-sized pieces of fresh rock were found considerably beyond the limit of the larger rock blocks. The

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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paths of the larger rock blocks could be traced through the forest by noting the trail of crushed vegetation, shattered boulders, and impact craters, whereas the smaller pieces were presumably airborne projectiles from points of impact along the cliff and high on the talus. Although large dust clouds were generated, no airblasts were observed from any of these rock falls, presumably because the rock blocks broke into moderate-sized pieces in impacts along the cliff by the time they reached the talus.... A trigger for the 16 November 1998 rock fall cannot be precisely determined. Minimum daily temperatures fell below freezing for 11 of 12 days prior to failure. During that same period 2.14 inches [5.4 cm] of rain fell with 0.40 inches [1 cm] in the 24-hour period preceding the rock fall. With the freezing temperatures and the availability of water, there is a strong possibility that the expansion of water in the joints during freezing and of the buildup of pore water pressures during thawing of the ice, weakened the rock mass and triggered the rock fall.... Another rock fall was heard in the same vicinity behind Curry Village at 10:50. An additional four or five smaller rock falls occurred later that night." (2) Guzzetti et al. (2003) mapped and modeled the runout extent and trajectories of this rock fall using the STONE rock-fall simulation model. (3) Matasci et al. (2011) performed structural analyses of the rock-fall source area using ground-based laser scanning (LiDAR) and computer software for measuring joint orientations and assessing slope stability. (4) Watts et al. (2007) and Watters et al. (2007) hypothesized that the 1998-1999 Curry Village rock falls were triggered by an overflowing water tank located upslope of the Glacier Point parking lot; this hypothesis was evaluated by Stock et al. (2012b) and shown to be highly unlikely based on the frequency of rock falls at Glacier Point, complex fracture patterns, lack of timing correlation, and the vastly larger quantities of water produced by local snowmelt.

1998111602 **Glacier Point** **Curry Village** **RF** **Fall** **11/16/1998** **See ID 1998111601**
See ID 1998111601

1998112901 **Glacier Point** **Curry Village** **RS** **Fall** **11/29/1998** **small**

(1) According to Yosemite Archives, National Park Service Papers, Protection Division, alley Patrol Shift Log Begin: March 10 1998 End: 18 May 1999 (written commun., 29 November 1998): "Curry guest reports rock fall (big) at 07:15 today in the Terrace area. Shift walked up. [cabins] 240's 241-242-244." (2) National Park Service Sunday night shift noted: "rain and some rocks continue to fall, above terrace, most recent about 19:00." (3) According to Jim Snyder (written commun., 14 January 2004): "The 240s are hard sided cabins that were just outside the 16 November 1998 closure line. Apparently these cabins, being the farthest toward the new Curry source, were checked for possible impact. Nothing was found. These rock falls occurred in the middle of a storm. Rainfall data from <http://cdec.water.ca.gov> shows that rainfall occurred as follows: 0.23 inches [0.58 cm] on 27 November; 0.13 inches [0.33 cm] on 28 November; 0.96 inches [2.44 cm] on 29 November; 2.07 inches [5.26 cm] on 30 November 1998. There was a lot of newly deposited, unstable rock from the Curry source of 16 November 1998 on the big ledge immediately below the source. There were no signs of change in the source itself when it was compared a couple of months later with a photograph of the source taken on 17 November 1998... These reported rock falls were most likely from the unstable material on the big ledge, which the storms triggered... There was no injury or damage associated with this event. The event was probably a rock slide, since the big ledge feeds a cliff [dipping] 50-60 degrees."

1999000001 **El Capitan** **Southeast Face** **RF** **n/a** **n/a/n/a/1999** **large**

From McNamara and van Leuven (2011), p. 106-107: "In 1998 the start [to the climbing route "Atlantic Ocean Wall"] was re-established [after a rock fall in the late 1980's], only to be destroyed in 1999 when the lower one hundred feet of the newly established route also fell off!"

1999042101	Yosemite Falls	Forbidden Wall	RF	Spring	4/21/1999 small
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(1) From John Stobinski, National Park Service (written commun., 23 April 1999): "99-136-Yosemite NP (CA)- Rock Slide with Visitor Injuries: Three hikers on Upper Yosemite Falls trail suffered minor injuries when several refrigerator-sized rocks dislodged from the cliff about 400 feet above them on the afternoon of 21 April. Two received cuts to their arms; the third received a head laceration from flying debris. Three rangers were sent up the trail to assist the injured and look for other casualties. A trail block was set up below the slide while the injured were assisted down the trail to an ambulance. A park trail crew that had been working about two miles below the slide was sent to assess the damage and look for hikers stranded above the slide. A helicopter flight was also made to assess the stability of the source zone. The trail was significantly damaged, and the area was found to be unsafe for hikers to pass through. Twenty-two hikers were trapped above the slide. They were moved to a landing zone above Yosemite Falls and evacuated by two helicopters. The trail will remain closed indefinitely while it is further assessed." (2) According to Jim Snyder (written commun. 29 April 1999): "This rock fall was coincident with the 1980 rock fall along the Yosemite Falls Trail ID 1980111601. At about 1 p.m. 21 April 1999, a rock fall occurred in the upper Yosemite Falls gully. ...The rock slide was evaluated that afternoon by Dan Horner, Jose Lopez, and Jim Snyder by helicopter, but there was too much wind for a very good look. A more thorough evaluation of the source area by air and from the ground was conducted by Mark Fincher, Tim Ludington, and Jim Snyder on 26 April, after giving the slide a few days to settle. Evaluation of the rock slide led to the following conclusions: 1. This small rock fall was part of a continuing rock fall as the exposed end of a vertical layer of rock slowly weathers and breaks away. 2. While there is very little left of the layer that fell, its source from the wall has in turn exposed another thinner, weaker layer, which has suffered more weathering and fracturing than the layer which used to enclose it. The end of that thinner layer appears relatively stable at present, though it will eventually come down. 3. There is, therefore, a long-term safety hazard remaining, one perhaps comparable to the long term hazard remaining on Middle Brother. The hazard cannot be removed effectively or safely by blasting or other rock removal from the cliff face, because the hazard rocks do not present a clean, clear target. 4. Closure for about two weeks to allow settling and adjustments in the source area will help confirm longer term stability. 5. Work on the trail will begin after that period to clean up the trail for summer use. The trail could be opened to the public by Memorial Day weekend. The closure need not be manned except during work hours on the trail when blasting or movement of large rocks create extra risks to others in the area... The rock fall was reported by a Swedish couple who watched it from above the impact area. They were at first in awe of what they saw. Only a little later, when they heard screams from people below caught in the dust and rock fragments, did they call on a cell phone. Their call was received by Park Dispatch at 13:05. Of the three injuries by flyrock, the most serious was a cut on the head of one young man who, though he never lost consciousness, thought the rock that grazed him was about the size of a football.... The Swedish couple later told McKenzie that the rock fall looked "like a large column" dropping from the face of the cliff, followed by lots of dust. It is not possible to determine a trigger for the event. There have been no recent earthquakes that can be related to the rock fall. Weather contributed to the failure. No doubt the series of wetter than normal winters since 1995 accelerated weathering processes. Weather during the month before the rock fall however, does not provide an explanation for the particular time of the event. Between 31 March and 11 April, the weather in Yosemite Valley was cold with low temperatures at or below freezing every night, with 2.55 inches [6.48 cm] of rain and 30 inches [76.2 cm] of snow on the Valley floor spread over the period. High temperatures were under 51 degrees F, usually in the 40's, sometimes the 30's during this period. That was followed by a dry, warming spell during which temperatures quickly rose with lows in the 40's after April 14 and highs in the 70's. Freezing and thawing was occurring at the source area (about 6,600 feet elevation) on April 12 through 14, but not after that when the line of freezing temperatures rose well above the valley rims... Varied weather patterns--sun and rain, clear and cloudy, warm and cold--

fed the fluctuating drainage behind and through the failed block. That block seems to have been free but for several attachments on its south or valley side. There was a great deal of soil behind it penetrated by large, long, mature roots coming from live oaks on the cliff above. Much of the exposed soil was washed away in the light rains of April 23 and 25, preceding our evaluation. Temperature, water, soil, and roots were the common elements contributing to this failure. They had worked together to weaken the hold on this small block until it finally failed. The size of the block cannot be exactly calculated. A generous allowance for the irregularly-shaped block would be 12 x 15 x 4 feet, or about 27 cubic yards, weighing around 63 tons. Rock structure has played a key role in continuing rock fall in this part of the Upper Falls gully. Standing above the trail and projecting from the cliff face are a number of layers or strata in the rock. Those vertical layers are separated by joints running approximately northeast-southwest, exposed by a million years of weathering to project from the cliff."

1999052501 Glacier Point Curry Village RF Spring 5/25/1999 small

(1) From Wieczorek and Snyder (1999): "At 9:12 am on 25 May 1999, a much smaller (53 yard³, 124 tons) rock fall occurred from the same general source area that reached the talus (see ID 1998111601). The rock fall occurred in two parts. The impact from one generated the other, leaving behind a conchoidal-shaped fracture on the lower source. The pattern of distribution of rock onto the talus was similar to that of the 16 November 1998 event, but covering a smaller area. Rock did not travel nearly as far, the farthest rocks traveling about 500 feet. Similarly, the zone of airborne splatter was confined to a smaller area on the talus.... No well-defined trigger for the 25 May event could be assigned, for there had been only a trace of rain several days before and no observed seismicity in the Yosemite Valley. Likewise ambient temperature change during the day is not a logical trigger for these rock falls since the timing of the events does not fit a clearly defined pattern." (2) Matasci et al. (2011) performed structural analyses of the rock-fall source area using ground-based laser scanning (LiDAR) and computer software for measuring joint orientations and assessing slope stability. (3) Watters et al. (2007) and Watts et al. (2007) hypothesized that the 1998-1999 Curry Village rock falls were triggered by an overflowing water tank located upslope of the Glacier Point parking lot; this hypothesis was evaluated by Stock et al. (2012b) and shown to be highly unlikely based on the frequency of rock falls at Glacier Point, complex fracture patterns, lack of timing correlation, and the vastly larger quantities of water produced by local snowmelt.

1999061301 Glacier Point Curry Village RF Spring 6/13/1999 medium

(1) From Wieczorek and Snyder (1999): "On 13 June 1999, an intermediate-sized rock fall of about 279 cubic yards (660 tons) occurred that killed one climber and injured two others who were climbing along a route beginning near the top of the eastern talus cone at Curry Village, immediately below the release area. The travel of rocks along the talus and airborne splatter of rock was again very similar to the previous observed distributions, extending to nearly the limits of the 16 November 1998 event [see ID 1998111602]. Some of these airborne splatter pieces reached the tent cabins and, falling at steep angles, pierced the canvas tops, broke beams, and fell to the floor. Two of the larger projectiles, approximately the size of a football, pierced the canvas roofs of Tents 28 and 36." (2) From American Alpine Club (2000): "After climbing in the Valley for a couple of weeks, Peter Terbush (22), Joseph Kewin (21), and Kerry Pyle (20) were nearing the end of their vacation. On June 13, in late afternoon, they decided to climb Apron Jam, a one pitch, 5.9 crack near the west end of Glacier Point Apron. Pyle led the pitch while Terbush belayed at the base and Kewin lounged beside him. Just after 7:30 pm, as Pyle was finishing the pitch, he heard a loud rumble above, and, within a second or two, boulders the size of Volkswagons were flying by to his right. He scrambled the last few feet to the belay (a pair of bolts), clipped in two quickdraws, and began forming a clove hitch in his rope, as a tie in. Before he could finish, rock fragments slammed into his head. He dropped the rope and simply grabbed the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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quickdraws and pressed himself against the wall. He grew faint and nauseous from the blows but hung on and survived. Without a helmet, he received severe scalp lacerations, but no other major injuries. As the rock fall ceased, he noticed that his lead rope was still snug, and called down to his friends. Kewin responded that he was OK but that Terbush might be dead. When the rock fall began, Kewin scrambled several feet east to get out of the way, and, like Pyle, hugged the wall. After the noise stopped, he went back to Terbush and found him unresponsive and pulseless. Terbush had not moved from his original position; in fact, he was still holding Pyle's rope as if on belay. Kewin removed the rope from Terbush's hands so that Pyle could use it to rappel, then he ran down to the parking lot for help. One ranger arrived a few minutes later and confirmed that Terbush had received fatal head injuries. The National Park Service delayed bringing Terbush out until it could assess the risk of more rock fall. On the 14th, National Park Service and U.S. Geological Survey specialists examined the source area by helicopter and telescope; despite a couple of very small rock falls that day, they permitted a ground team to make the recovery on the 15th." (3) From Wieczorek and Snyder (1999): "The peak of runoff of the Merced River in late May and early June suggests that the two rock falls of 25 May and 13 June 1999 were possibly related to the buildup of pressures in joints from infiltration and fracture flow from spring snowmelt [at Glacier Point], but it is not possible to better substantiate the timing nor the magnitude of the cleft pressures. The timing of the initial 16 November 1998 rock fall does not fit the pattern of influence from spring snowmelt; however, it does fit the freeze-thaw pattern of early winter storms with temperatures alternating above and below freezing in the days preceding the event." [Subsequent monitoring of seepage at the source area showed a greater degree of correlation with precipitation events rather than snowmelt. 1.3 cm of precipitation, in the form of snow, fell at Glacier Point on 3 June 1999 and subsequently melted over the next several days, providing a possible source of seepage observed at the source area following the 13 June 1999 rock fall.] (4) Matasci et al. (2011) performed structural analyses of the rock-fall source area using ground-based laser scanning (LiDAR) and computer software for measuring joint orientations and assessing slope stability. (5) Crack propagation following the 13 June 1999 rock fall was analyzed by Chau and Lin (2011) and found to most likely relate to high horizontal stresses within the cliff. (6) The fatality resulting from this rock fall precipitated a lawsuit against the National Park Service (Terbush vs. United States) in 2001, in which Plaintiffs argued that the National Park Service failed to properly warn the climbers of the hazard, and that the National Park Service triggered the rock fall by allowing water to overflow from a water supply tank upslope of the Glacier Point parking lot. Plaintiffs argued that rock fractures directed this water to the cliff, triggering the rock fall by elevating cleft pressures behind an exfoliation slab. The water-system triggering hypothesis was presented in Watters et al. (2007) and Watts et al. (2007). The case was dismissed by the U.S. District Court (Eastern District of California, Fresno Branch) in 2005, appealed to the 9th Circuit Court, partially remanded to the District Court in 2008 to address remaining issues of maintenance, and dismissed again by the District Court in 2010. The water-system triggering hypothesis was evaluated by Stock et al. (2012b) and shown to be highly unlikely based on the frequency of rock falls at Glacier Point, complex fracture patterns, lack of timing correlation, and the vastly larger quantities of water produced by local snowmelt.

1999061501	Glacier Point	Curry Village	RF	Spring	6/15/1999	very small
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(1) From Wieczorek and Snyder (1999): "...new fractures accompanied a small rock fall (13 yard³; 32 tons) from the 16 November [1998] source area that was heard about 1:13 pm [15 June] throughout the Yosemite Valley." Flyrock from this event damaged Terrace Tent 29. (2) Crack propagation following the 13 June 1999 rock fall was analyzed by Chau and Lin (2011) and found to most likely relate to high horizontal stresses in the cliff.

1999061701	Half Dome	Sierra Point	RF	Spring	6/17/1999	small
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ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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According to rock climber Karl Bralich (written commun., Google Groups, rec.climbing): A rock fall occurred on the western shoulder of Half Dome near Sierra Point. Bralich, "went to Glacier Point for the sunrise... and saw a rock fall just to the left of Sierra Point that was loud and raised a fair amount of dust."

1999061702 Glacier Point Curry Village RF Spring 6/17/1999 very small

From Wieczorek and Snyder (1999): "On June 17 another small rock fall occurred which was again correlated with further extension of fissures and new hairline cracks observed subsequently."

1999071401 Glacier Point Curry Village RF Summer 7/14/1999 very small

From Wieczorek and Snyder (1999): "A backpacker in the Wilderness Parking Lot observed a 'large' rock falling from the [1998-1999 Curry Village] source area, crashing down to the ledge, then down the ramp, shattering and creating a dust cloud by the time it was three quarters of the way down the ramp. This followed 0.18 inches [0.46 cm] of rain in an afternoon thunderstorm on 13 July 1999. The rock came from the roof of the 13 June 1999 source area. Rainfall from the Glacier Point Apron carried fresh rock fall sediments in a small channel along the cliff face to the Wilderness Parking Lot."

1999081101 Panorama Cliff Panorama Cliff RF Summer 8/11/1999 small

According to Jim Snyder (written commun. 4 October 2001): "Noreen Trombley was hiking up the Nevada Falls Horse Trail to resume her Resources Management work in Little Yosemite Valley when she heard a sound like "an airplane" followed quickly by rock hitting the cliffs above her. She ran down the trail for cover behind a large rock, yelling to two backpackers to do the same. Of the two, the woman received a minor head injury as she was grazed by rock, as well as a leg abrasion. The man's camcorder was hit by rock. Noreen called the rock fall in to Park Dispatch at 7:20 a.m. while it was still happening. Trail supervisor Tim Ludington and Jim Snyder inspected the trail soon afterwards, also locating the source area high above on the Panorama Cliffs. The thin sheet of rock that fell broke up many times against the cliff as it fell a little over a thousand feet to the Nevada Falls Horse Trail. The switchbacks at Valley View (western-most switchback corner on the trail) acted as catch basins for the falling and flying debris. The trail was covered with rock and live oak branches cut down by falling rock. The largest rock on the trail from the rock fall was about 3 x 3 x 4 feet, showing that the failed sheet had broken up thoroughly on the way down. The rock fall knocked out top courses on 60 to 80 feet of trail wall. Falling rock moved several larger rocks formerly on the inside of the trail down on to the trail itself. The trail will be cleared for administrative use while reconstruction occurs. The trail will probably be reopened without restriction in about a month. The source area was on a sheer cliff at about 6,100 feet elevation. I [Snyder] flew the source area [by helicopter] to examine it closely. The failed block was probably around 25 feet high and 20 feet wide to judge from nearby vegetation. The sheet was quite thin but up to three or four feet thick along a vertical axis. Its failure left a small roof defined like the bottom of the sheet by a horizontal joint set. There were no new cracks around the source to suggest further failures from this point in the near future. The source area was dirty and had been penetrated deeply by roots from a nearby shrub (not a live oak). The long, fine root mass from this low-growing shrub had extended far behind the failed sheet but now hung down below the source, swinging in the breeze. There was no moisture in the source area. The 0.08 inches [0.2 cm] of rain in a thunderstorm on the early morning of 10 August 1999 may not have contributed to the rock fall. Volume of the failed sheet was probably between 37 and 56 cubic yards (87 and 131 tons). The rock fall had heavy impacts on the cliff, grinding and powdering, rather than breaking, rock. The steep but bulging cliff had the effect of spreading the rock fall east and west as it broke, strafing the trail and forest with flyrock over a considerable area. Impacts below the cliff on the trail and talus moved a great deal of other material downslope. One old fir showed four other flyrock scars in addition to a new one from this rock fall."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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While a couple of scars may have come from trail work, the orientation of all the scars indicated earlier rock fall from sources in the same general area. When the sheet failed, it dropped to a sloping ledge covered with other rock, soil, and vegetation. At the back of this ledge was a large block, partially pulled away from the cliff to leave a deep, narrow slot behind, into which the failed slab fell. While much of it stayed in the slot, more of it fell out to the ledge before falling down the cliff face. On the ledge are several fragments of the slab, one of them perhaps 10 feet square. That fragment hit the soil flat and moved downhill a few feet before stopping. Another smaller piece remains perched on the edge, partly in dirt and partly on bedrock, with a lot of friction preventing its immediate slippage. There are many smaller chunks of broken rock on the ledge, but they are on dirt and other rock rather than on the very edge of the ledge. Since the ledge material has been loosened by rock fall, however, there will be some danger of small material slipping off this fall season. Winds may move some rock by blowing loosened, supporting soil away. Rains will certainly initiate some movement of loose material on the ledge, especially when ledge soils become saturated. Any danger from immediate rock fall from this area, then, comes not from the source area, which appears clean, but from the sloping ledge underneath it. Workers on the trail should be aware of this potential. Information about the potential for small rock fall should also be made available to hikers, perhaps through trail condition reports, once the trail reopens for general use."

1999100201 Yosemite Falls Sunnyside Bench RF Fall 10/2-3/1999 very small

According to Jim Snyder (oral commun., 4 October 1999): A small rock fall [occurred] on Sunnyside Bench during this weekend (2-3 October 1999).

1999102801 Glacier Point Curry Village RF Fall 10/28/1999 very small

According to Jim Snyder (oral commun., 28 October 1999): At 08:50 janitors reported two small rocks fell on top of tents on the Terrace at Curry Village, which were being removed. The source of the rocks was unknown, but they were probably flyrock from impacts of other rock falling from the ledge below the Curry Village source.

1999110801 Sentinel Rock Sentinel Rock RF Fall 11/8/1999 large

According to Jim Snyder (oral commun., 8 November 1999): At 04:20 on 8 November, a rock slide occurred west of Sentinel Rock. A couple of rocks 100 feet across and 100 feet high sourced and left an arch or triangular shape.

1999110901 Sentinel Rock Sentinel Rock RF Fall 11/9/1999 large

According to Jim Snyder (oral commun., 9 November 1999): At 08:18 on 9 November another rock fall occurred at Sentinel Rock strong enough to shake a patrol car at the El Capitan cutover. The source was about 200 feet across, 100 feet high, and 5-10 feet thick.

2000020801 Merced River Gorge El Portal Road / Dog Rock RF Winter 2/8/2000 very small

According to Jim Snyder (written commun. 15 February 2000): "The rock fall below Dog Rock was reported to Park Dispatch at 12:25 p.m. PST, 8 February 2000. Workers on the El Portal Road heard rock fall above them and ran for cover. They saw one rock hit the steep cliff above another larger rock come off the cliff top. The rocks that made it to the road were described as two to four feet in size. One the size of "a car engine" hit the hood of an explosives truck. Another, falling from a different track off the cliff above, made an impact crater in the outside road shoulder. There were no injuries, but the event was a frightening demonstration of the vulnerability of the roadway to even small rock fall from far above. At about 3:30 p.m. we checked the source area by helicopter. We could see one larger impact point roughly halfway down the cliff and other smaller impacts from the resulting splatter. Finding the

source was difficult, however, since it was far above the location observed from the road. At length we located the rock's track through brush and grass, following it to the small source area about 1,700 feet above the road. The source was located on a map and photographed, but the source area was too small in an area cluttered with brush and other rocks to (be) observed clearly by air. To make a better evaluation of its safety and stability, we resolved to hike in for a closer look. In the meantime the El Portal Road was closed to through traffic in case more material came down. On the morning of 9 February, Mike Shenton and Brian Ward from Trails hiked in from Foresta with Jim Snyder to the source area. Finding the small source on a steep brush-covered slope was slow, but close observation of the source helped answer questions about how the rock fall had occurred and about its stability. The size of the failed block was approximately 5 feet high, six feet across, and four feet through. It was irregularly shaped. Numerous fractures within it had been weathered through. With only a small attachment at its rear, the block sat atop a 3 x 3 x 1 feet plate that stood upright in soft grassy soil. As the block failed, it pulled the lower plate out, which had the effect of throwing the larger block, giving it an initial velocity it might not have otherwise had. The smaller plate ploughed into the soft earth some 40 feet below the source. The larger block broke into several pieces along weathered fracture lines to create a corridor of closely braided tracks down the steep (33-35 degree) slope. The slope has many outcrops of rock set in soft soils, moist but not wet while we were there, into which our boots sank ankle deep. The soil absorbed much of the force of the descending rock. Some of that force was also transferred to other rocks dislodged from their perches and sent down the hill. The larger rocks slid, rolled, bounded to careen down the steep hillside through soft soil and brush, hitting many obstructions and changing paths. A hundred feet below the source, the largest rock knocked over a burned cedar snag three feet in diameter. A hundred feet below that, the rock plowed through a down log and knocked over a twelve-inch live oak. Some of the loosened rocks and pieces doubtless came to rest before reaching the cliff some 700 feet away from the source area. Several of the larger rocks did not, although their paths were so altered by obstacles that they appeared to come off the cliff from different locations. Once they reached the cliff edge, they could gain velocity unimpeded in their down-slope plunge, except for impacts against the wall. The source area is relatively stable. The remaining block is fractured and the fractures penetrated by roots and dirt. The exposed rock on this slope is all very weathered. Some of it shows signs of slight movement in the last several years. The minor movement of one larger rock appeared related to the storms that produced the 1997 flood. The slope has been developed by much weathering and movement over a period of a million years or more. Its deep soils and rounded, broken rock discolored by chemical change all show the length and depth of this containing process. We could not determine the exact trigger of this particular rock fall even though contributing factors to it were much in evidence. First, there was very little freshly broken rock. The failure occurred along very weathered fracture lines. One fine fracture was partly broken through with signs of discoloring from oxidation, while other wider breaks were filled with dirt and roots. Only one part of the final break was fresh. Second, roots of live oak and particularly poison oak had penetrated the slowly crumbling block throughout. There were mats of small poison oak roots at the bottom of the source and one large root, 1.5 inches diameter, growing through one side of the failed block. Third were several large burn scars deep inside the failed rock. These scars formed during the 1990 Foresta fire when fire followed existing roots to smolder deep inside the rock. The thick poison oak root had sprouted after the fire to reclaim its burned territory. While the regrowth of that rootstock acted to widen and weather older fractures, heat from the fire certainly contributed to weakening the rock along weathered fractures as well. Fourth, the rains of the previous ten days probably contributed to the failure. There had been some minor drainage around the rock, overturning small rock fragments. There was some seepage through and behind the rock shown by small ferns growing at the base of the source underneath the former failed overhang. A combination of these factors contributed to the failure. All of them relate to the processes of weathering, but none of them can be singled out as the trigger for the 8 February rock fall.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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There was a blast by the contractor on the El Portal Road called in to National Park Service Park Dispatch at 11:48 a.m., about thirty minutes prior to the rock fall. Though coincidental, we do not believe there is relationship between the blast and the subsequent rock fall. The blast was quite small, a cleanup shot of "a few sticks" in a road cut rather than bedrock. The blast was also about 2,500 feet away from the source area."

2000022201 Three Brothers Middle Brother RF Winter 2/22/2000 very large

According to Jim Snyder (written commun. 2 August 2000): "When the rock fall from above Rixon's Pinnacle just east of Middle Brother occurred on 22 February 2000, it was the first larger rock fall from that area in over a decade. A photographer along the river and Leidig Meadow heard occasional smaller rocks after 7:30 am but paid no attention. A Yosemite Concession Services bus passed through Northside Drive just 15 seconds ahead of the rock fall at 08:36; passengers saw and heard it behind them. The photographer dropped his camera bag full of gear and ran for cover behind a tree, unharmed except for an intestinal source triggered by the sudden, frightening event. In the Research Library on the second floor of the concrete and rock Museum Building about 1.3 miles east, I [Snyder] heard the rock fall and felt the impact shock waves from the source, checked with Park Dispatch, and left for the scene of the event. The source from about 5,600 feet was clearly visible from the Ranger Club "Y" on Northside Drive; dust was still rising from the source area and talus... Conclusions on failure sizes remain problematic. Cliff features can be roughly calculated from the 7.5' Half Dome topographic map which shows the cliff pretty clearly. By applying the height of cliff features to older Search and Rescue photographs of the cliff taken in the 1970's, I [Snyder] derived an estimated height of 224 feet for the 22 February 2000 failure. Width and thickness, however, were difficult to pin down since there was great variation in the block. After numerous calculations I settled on a width of 87 feet and a thickness varying up to 37 feet. The resulting estimate of the failure, with adjustments for varying shape, was 22,843 cubic yards or about 55,206 tons (for the earlier failure)."

2000022202 Three Brothers Middle Brother RF Winter 2/22/2000 small

According to Jim Snyder (written commun. 2 August 2000): "Following the [22 February 2000 rock fall (see ID 2000022201)], the Valley road crew went immediately to the area [Middle Brother] and walked down Northside Drive, checking for road damage. They were in the middle of the rock fall area when at 08:55, another rock fall occurred. They alternately ran and fell trying to get away; they were unharmed but shaken. This second smaller source came from a flake hit hard by the first rock fall. Following this second source, other smaller rock fall continued to occur in a random manner. Northside Drive had to remain closed as long as there was instability. ... Roadblocks were established at El Capitan Bridge and at Camp 4, Leidig Meadow cordoned off, and rock fall monitors posted near the trail crossing of Northside Drive below Camp 4. Weather contributed to this rock fall but cannot be assigned as its trigger. The winter in Yosemite had been dry before January with warm spells and little freezing on the Valley floor. January brought several storms and temperatures around freezing at the Valley floor elevation. Snowlines fluctuated between 5,000 and 6,500 feet. A relatively warm storm came through between 10-17 February (6.18 inches [15.7 cm] of rain) and another small storm on 20-21 February (0.66 inches [1.68 cm] of rain) with snowlines near the source. 22 February was clear with a low temperature of 33 degrees Fahrenheit on the valley floor. Temperatures had been freezing at the source before 22 February, but the storm had stopped hours before morning. Although 22 February was clear, stormy weather returned on 23 February. These new storms, with one break on 26 February, brought frequent snow to the valley floor and lasted into 1 March. These storms generated small rock fall from ledge bound debris below the 22 February source. Low snowlines in these storms suggest a period of sustained freezing and thawing at the elevations of the source. This period of storm and temperature fluctuation was the probable trigger for a larger rock fall on March 1 from a source area

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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approximately 600 feet east of the 22 February source. Using the height of the first block for comparison allowed a calculation of the smaller second 22 February block as 52 cubic yards or about 124 tons."

2000030101 Three Brothers Middle Brother RF Winter 3/1/2000 very large

According to Jim Snyder (written commun. 2 August 2000): "A rock fall occurred at about 04:54 [on 1 March 2000 from Middle Brother], in an area already closed by the 22 February 2000 rock fall. While the noise of the rock fall woke me up, many others in the area also felt the impact of it up to 1.5 miles east of the source. Visitors at Yosemite Lodge and campers in Camp 4 were jarred awake by the event, which sounded as if it was almost on top of them. Although no one heard or felt this rock fall as anything but a single event, the seismic record indicated two rock falls about 10 seconds apart, the second two to three times larger than the first (Robert Norris, U.S. Geological Survey, commun., 2 March 2000). This rock fall was obviously larger than the 22 February event, clearing a greater area of woods off the talus cone below the climbing route called "The Folly" and sending more rock farther across Northside Drive. The closure was moved east closer to Camp 4, while monitoring continued. Trying to use 22 February block figures as ratios for the 1 March failure on both photographs and maps was marginally successful. I concluded, with uncertainty, that the 1 March failure was about 245 feet high, 182 feet wide and averaged 20 feet thick. With adjustments for variations in shape and thickness, I [Snyder] arrived at a ballpark figure of 27,068 cubic yards or 63,949 tons. I [Snyder] checked rock fall lines following each event. Talus or larger rock extended to or lay behind base of talus lines mapped by the US Geological Survey (Wieczorek et al., 1999). The 1 March rock fall reached the (talus) line because it fell directly to it, more or less unobstructed. The 22 February rock fall generally stayed behind the line. Falling as it did on the east side of the Rocky Point talus cone, it was deflected in that direction. Flyrock followed the talus patterns of these two rock falls... Unlike the Curry Village rock falls which produced a mix of smaller sizes of flyrock down to a couple inches, flyrock from the 22 February and 1 March rock falls was much larger and more dispersed... Flyrock [from the 1 March rock fall] ranged in size from about 0.25 to 3.75 cubic feet and travelled as far as 300 feet beyond the road toward the river. Flyrock [from 22 February rock fall] ranged from one-quarter to about 2 cubic feet and does not seem to have gone more than about 120 feet beyond the road. The differences in distance are related to breakage on the way down, restraint on intervening ledges midway, angles of the cliffs along which the rocks fell, and conformations of the distant talus cones. While most larger pieces of the 1 March flyrock tended southeast from the talus some smaller flyrock of softball size and somewhat larger went into the west end of the old Indian village. The only rock fall I know in Yosemite Valley for which the agency of pore water pressure can be shown was the Middle Brother failure of 1 March 2000, for which a photograph shows previously trapped water dispersing across the new face shortly after the failure and despite freezing temperatures on the cliff face and Valley floor... Road reopening was recommended after road repairs were completed. We suggested that the "No Stopping Next 1/4 Mile/Rock Slide Area" signs be changed to say "1/2 Mile" and be moved to further east on Northside Drive. Recognizing that spring conditions with storms and runoff could bring more changes in the sources, it was decided initially to reopen the road Thursday, 23 March 2000. An administrative decision to leave the road closed for the Secretary of the Interior's announcement of the Draft Yosemite Valley Plan and press conference in Yosemite Valley postponed the actual opening to Thursday, 30 March 2000 so the press could see two-way traffic on Southside Drive."

2000030601 Three Brothers Middle Brother RF Winter 3/6/2000 medium

According to Jim Snyder (written commun. 2 August 2000): "At 04:00 on 6 March 2000, a large rock fall was reported from Middle Brother. Storms prevented locating the failure until the following day, when

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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we were able to see the new failure from the 1 March 2000 source area [see ID 2000030101] of a large slab along its upper and eastern perimeter."

2000031401 Glacier Point Curry Village RF Winter 3/14/2000 very small

According to Jim Snyder (oral commun. 14 March 2000): At 10:47 on 14 March 2000 a small rock fall occurred from the Camp Curry source area (see IDs 199811601, 199811602, 1999052501, 1999061301, 1999061501, and 1999071401). By 15:00 snow was almost all melted from the source area, no ice on source, more dry area on source.

2000040101 Half Dome north of Grizzly Peak RS Spring 4/1/2000 medium

According to Gary Hayes (web site communication, 3 May 2000: <http://virtual.yosemite.cc.ca.us/ghayes/rock slide.htm>): Rock slide of 1 April 2000: The rock slide began about 2,000 feet above the valley floor southwest of Half Dome and the Diving Board ridge. Boulders slid and rolled down the slope, and eventually free-fell onto the talus slopes below [between Happy Isles and the Mirror Lake bus stop]. Hayes, a geology professor, was in Stoneman Meadow when the slide began and observed the event. An investigation of the trail and road near Happy Isles revealed that no rocks made it to the valley floor.

2000040201 Three Brothers Middle Brother RF Spring 4/2/2000 very small

According to Jim Snyder (written commun. 2 August 2000): "Like other cliffs [in Yosemite Valley], the wall of Middle Brother is relatively stable but seems regularly to dribble rock. A small rock fall occurred Sunday, 2 April 2000, at 04:00. It was found to be a small plate which had been hanging in the upper east part of the 1 March 2000 Middle Brother source and which had earlier been observed by me [Snyder] to be nearly cracked through. The failure may have been as large as 1.75 cubic yards or about four tons. Since it occurred early on Sunday morning and was little noticed, there was no [road] closure."

2000051701 Three Brothers Middle Brother RF Spring 5/17/2000 small

According to Jim Snyder (written commun. 2 August 2000): "About 12:25 on 17 May 2000, a noisy rock fall with a little dust came from the same location as the 22 February 2000 Middle Brother rock falls (see IDs 2000022201 and 2000022202). Northside Drive was closed while the rock fall source area was evaluated. The rock fall followed a brief storm on 16-17 May which delivered 0.60 inches (1.52 cm). The rock fall had clearly come from the top of the 22 February 2000 source. The 22 February 2000 failure was mostly from more massive though weathered rock. At the top of the source is a horizontal joint, well penetrated by roots, above which are finely-jointed, well weathered rock. These have been unloading a little at a time almost continuously through decades past. A 1970's Search and Rescue photo (#5283) shows an open area there and wide white marks down the cliff scraped clean by falling rocks. The 17 May failure appears to have been a long slab lying just above more massive rock on the cliff. This slab was overlaid by more weathered, highly jointed rock surrounded by roots with mud underneath and behind. The slab pulled away and brought some of the more weathered rock with it. Altogether the failure may have been as much as 18.5 cubic yards or about 44 tons, though these crude estimates are problematic and probably high. The road was closed for 24 hours while the source was monitored. No further rock fall occurred, but the closure was extended to 48 hours ... the road reopened at 10:00 on Friday 19 May instead. In checking this rock fall, I [Snyder] found that the failed rock was largely swallowed up by the cliff, its ledges, and the Rocky Point talus cone. Even though storm flows had created an ideal palette for distinguishing new rock from slightly older rock fall, I [Snyder] was able to find only one rock < 1 cubic foot clearly from the 17 May event. It had come to rest roughly

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halfway down the talus cone about 300 feet north of Northside Drive. No smaller flyrock could be located lying on top of freshly laid debris."

2000061401 Glacier Point Curry Village RF Spring 6/14/2000 very small

According to Jim Snyder (written commun. 15 June 2000): "On 14 June 2000 at 2:08 pm, a small rock fall from the Curry Village source area was observed by Patricia W. of National Park Service Buildings and Grounds from the wilderness parking lot. Jim Tucker and I accompanied Patricia to her original vantage point, from which she provided a positive location for the rock fall on the cliff. From her observations we could see that the small rock fall came from the east end of the 13 June 1999 source area and that it fell on the east end of the large underlying ledge through a slightly wet drainage there. From that point the rock cascaded down the ramped cliff to the talus below. Observation of the source with the Questar an hour later revealed no specific source. At the east end of the 13 June source, however, there are several thin, broken slabs of rock. These flakes were left from the 13 June 1999 failure, and some fell again on 14 July 1999 from that point. There is still some loose material there, but it is not large and is not an indicator of anything larger waiting to come down. There are no new, extended, or changed cracks around that part of the source area to indicate increased rock fall potential from it. This small rock fall did not come from the cracking blocks which have been under observation for a full year now... On June 15 I hiked to the top of the talus cone to locate evidence of the rock fall. There were several new small blocks of less than two cubic feet each with small fresh dust and impact marks. These travelled no more than 150 feet from the cliff face. Small as they were, these blocks did not initiate flyrock. Patches of open dirt in the talus allowed tracking of the flyrock which travelled about 225 feet from the cliff face. These patterns fit the patterns of talus and flyrock from the other three Curry Village rock falls and from the several Middle Brother rock falls this spring. That pattern is that the larger the rock fall the greater the distance travelled by large rock and flyrock, conditioned by the conformation of the cliff face and talus beneath. The rock that fell, since it came from the east side of the source, was funneled through the east side of the ledge below it. On the talus the falling rock was directed roughly northeast, largely away from the Terrace. The rock seemed to follow prominent lines of fall toward the northeast in both the 16 November 1998 and 13 June 2000 rock falls.... Because the rock fall was small, with no impact to nearby facilities, there was no closure or evacuation of any of Curry Village. It was so obviously small and unthreatening that YCS employees in Terrace housing took the event in stride, even though they are all prepared to implement evacuation procedures in a larger rock fall emergency..."

2000082901 Grizzly Peak Grizzly Peak RS Summer 8/29/2000 small

According to Jim Snyder (written commun. 10 December 2003): "A rock slide occurred about 7:30 am on 29 August 2000 near Grizzly Peak. I checked this source by helicopter on 30 August 2000 after checking the Curry Village source. The source was located on the north side of Grizzly Peak at about 6000 ft. elevation. A large weathered block broke off another block near the top of the peak and fell, taking other rock with it. The rock slid north into a gully oriented northwest below Grizzly Peak, coming to rest in a less steeply inclined, wooded part of that gully at about 5,300 ft. elevation, shown clearly on the Half Dome 7.5-minute topographic quadrangle. The block and other material amounted to about 20 x 5 x 10 feet or about 37.5 cubic yards and 87.5 tons. The rock slide stopped far above the Vernal Fall and John Muir Trail."

2000082902 Glacier Point Curry Village RF Summer 8/29/2000 small

According to Jim Snyder (written commun. 31 August 2000; 23 January 2001): "At 22:30 on 29 August 2000, a block of about 20 cubic yards or 50 tons fell from the roof of the 16 November 1998, Curry Village rock fall source area. Flyrock reached the upper part of Curry Village which was closed for observation. Guest accommodations were reopened at noon, 1 September, for the Labor Day weekend."

While generally within the patterns of earlier flyrock, the impacts of this rock fall were noticeably different. Normally a smaller rock fall would not reach far down the talus slope. In this case, one five-to ten-ton boulder exploded on impact to send a fan of larger flyrock into closed accommodations, emphasizing the unpredictability of rock fall. Regular observations of the cliff above Curry Village since 15 June 1999 also suggest very subtle rock movement on the cliff face as well as unexplained changes in subsurface drainage in and around the source areas... Ranger noted occupants of the Terrace and guest tents quickly self-evacuated before the area was cordoned off for evaluation. Information about the range of flyrock was used to establish a safe area and closure. The cliff face was monitored by YCS Security for noise signifying further activity.... YCS Security reported small popping noises at 5:06 and 6:52 a.m., 30 August 2000. No further noise was reported from the source area. ...Since there was no further rock fall, the closure was lifted about noon, 1 September, as the Labor Day weekend began.... The 29 August 2000, failure followed very generally the patterns of earlier Curry Village failures from the same source by landing within the area we thought would contain a failure of the observed weak formation. The 29 August rock fall was small in comparison with earlier Curry events. It began as a roughly triangular block of about 11 feet high, nearly 20 feet long, and approximately 5 feet thick. The failure consisted of about 20 cubic yards weighing about 48 tons (dimensions were measured from scaled photographs of the 13 June 1999 source. Small and coming from an unexpected source, the 29 August failure nevertheless did send a very few pieces of flyrock into parts of Curry Village where it was not expected. The flyrock pattern of this size rock fall clearly did not replicate flyrock patterns established in earlier rock fall... There seems no way to easily explain the 29 August failure or to discover a trigger or immediate cause for it. There had been no temperatures near freezing at the source. There had been no rainfall before the failure, although there was 0.09 inches [0.23 cm] the day following, 0.05 inches [0.13 cm] on 1 September, and 0.45 inches [1.14 cm] on 2 September. The Curry Village source was over 95% dry when observed 28 August and again on 30 August. The source was 90% dry on 1 September, a slight change following light showers. There was some seepage with fine brown soil visible behind the failed block on 30 August, and there were also some fine roots visible in the back of the new source. Seepage along the joint parallel to the cliff face (J1) covered about 30% of the new source as observed the morning of 30 August by helicopter. This seepage was apparently pre-existing, to judge from similar seepage along the same joint immediately east, and not the result of a source of water stored in a closed joint. A cause for this source cannot be clearly assigned to earthquake, freeze-thaw, storms, runoff, pore water pressure, or vegetation penetration. From the weak formation under observation, the block(s) fell toward the large horizontal ledge which has been a catch basin for much Curry rock fall since November 1998. The blocks hit a previously hammered slab just above the ledge, breaking up part of it by impact, perhaps 200 tons of additional rock. Most of this new rock landed on the broad ledge less than 30 feet below. The ledge held most of the falling rock, including some large slabs. The pile of debris on the ledge was sufficiently disturbed that dirt was washing out the ledge center during the 1 September 2000 rain. Some rock went over the ledge and down the long, glaciated ramp into the talus. There was relatively little dust with the 29 August 2000 failure. Dust in quantities enough to leave a film on the ground and on tent frames reached only into the closed top portion of the Terrace to about Tent 30. There was very little larger rock in evidence on the talus and few new impacts in the talus, mostly near the top of the cone. There were, however, a couple of two-inch flyrock pieces above the Wilderness Parking Lot east of Curry Village. A baseball-size piece of flyrock went through the canvas roof of closed Tent 247 to bounce and roll out toward Tent 340 on the west. In the middle, a rock the size of a football went through Tent 327, coming to rest outside Tent 325 just across from it. There was a report of flyrock near Cabin 214 and the pool, but with several efforts we could find neither flyrock nor impacts anywhere in that vicinity. Behind this wide scattering of smaller flyrock was a more restricted area hit by larger flyrock of a half cubic foot or more. Flyrock this size entered the closed upper section of the Terrace, damaging about 10 tent frames without canvas and coming to rest on

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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several others. Larger flyrock also came to rest in the talus behind the back row of guest tents 326-347. Talus there provided catch basins for this flyrock. Still, this was larger flyrock farther down the slope than we had seen following any of the earlier, much larger rock falls. Examining the talus slope on 5 September 2000, photographer Michael Dixon and Snyder were puzzled by the lack of new rock or impact craters on the talus. We could find no pattern in the erratic paths of flyrock. Nearly all the new vegetation that had grown up following the 13 June 1999 failure remained undamaged. But close to the west edge of the new 1998-1999 opening on the talus cone was a single new track of a block bounding down the slope. There were sliding marks and impact craters perhaps 30 feet apart in a line down the slope. While the size of the craters may be a poor source of information about the size of the rock, we could guess that it may have been four to five feet in diameter, weighing five to ten tons. The track ended in the larger talus just inside the trees. Surrounded by large rocks from the 16 November 1998 and other rock fall was one large rock hit directly on top by the new block racing down the slope. The impact popped the SUV-size rock into three pieces. The falling rock exploded on impact, sending the flyrock out in a large fan. ... Distribution of larger flyrock shows how flyrock fanned out from this one point of impact. The impact location helps explain the anomaly of a smaller rock fall generating larger flyrock outside the patterns established by earlier and larger rock fall from the Curry Village source area. The flyrock came not from the size of the rock fall but from one particular block's chance impact with another in talus."

2000111001 Three Brothers Middle Brother RF Fall 11/10/2000 medium

According to Jim Snyder (written commun., 15 November 2000): "A rock fall occurred at Middle Brother at 12:05 pm, on Saturday, November 11, 2000. The source was high, possibly near the location of the March 1987 source (ID 1987031001). Several 5-ton boulders and one 10-ton boulder reached the road and a 5-7 ton rock nearly reached the Merced River. One vehicle was damaged and one injury occurred from the rock fall. The night before temperatures were below freezing (23 degrees) and there had been some rain during the previous days. A Curry employee staying at Camp 4 heard cracking and popping the night before the rock fall. The source involved a small plate above the ledge system that was visible in 1987 photos. The source which was about 600 to 800' west of the 22 February 2000 source, was about 30 feet wide, 15 feet high, and 5-8 feet thick, amounting to about 108 cubic yards. A secondary source of additional material (10-20 tons) occurred about halfway down the fall path."

2001021201 Merced River Gorge El Portal Road/Dog Rock RF Winter 2/12/2001 small

(1) According to National Park Service Ranger Susan Gonshor (written commun., 12 February 2001): "A rock fall occurred along Highway 140 within Yosemite National Park approximately 1/2 mile east of the park boundary in El Portal. Rocks and boulders, ranging in size from 2 feet to 12 feet in diameter were scattered over approximately 100 yards of roadway. The release point of the slide is approximately 1,000 feet above the roadway and above any previous road construction work... Only minor damage occurred to the road and guardwall..." (2) According to National Park Service Web site (13 February 2001): Yesterday, during a heavy storm at local time 2:30 am 12 February 2001 there was a (~5 cubic meters) rock fall along Highway 140 (known as the All Weather Highway or El Portal Road), just within the boundary of Yosemite National Park, California. The road remains blocked, but is expected to reopen later today, 13 February 2001. The site of the rock fall is nearly identical to that of a similar sized rock fall [3.4 cubic meters] that occurred last year [8 February 2000] in extremely weathered granite. The source area of this rock fall is believed to be about 1,000 feet above the highway, but was not located definitively.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2001031801 Rockslides Old Big Oak Flat Road RS Winter 3/18/2001 small

According to Jim Snyder (written commun. 27 November 2001): "18 March 2001, 3 pm, Old Big Oak Flat Road below the switchback. Sarina Lambert was hiking this day, heard the rock fall, and saw the evidence of it on the road on her way down. It was mostly clear day with snow on the ground. I went to the area later and saw the evidence but could not isolate the source area. It is possible that this was a rearrangement of talus. I could follow the track up the talus several hundred feet but could not follow it to a source area on the cliff. In any case, several large (1-3 cubic meters) boulders came loose and fanned out down the talus slope. A 2 foot cedar was knocked over by one of them. Some came to rest just above the road on earlier rock fall, but others crossed the road and went down another several hundred feet below it."

2001050601 Glacier Point Curry Village RF Spring 5/6/2001 extremely small

According to Jim Snyder (written commun. 21 May 2001): "At Glacier Point-Curry Village onto the edge of talus above Curry Village, a National Park Service Ranger reported 5-7 seconds of rock-fall noise, probably from loose rock falling from the ledge; no visible change in Curry source rock fall areas; several snowmelt runoff channels on the ledge had loose rock of basketball size. No dust generated by rock fall."

2001051701 Sentinel Rock Sentinel Creek RF Spring 5/17/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "17 May 2001, Sentinel Creek, 3:45 pm. Valley District Ranger Steve Yu heard 10 seconds of rock fall from the Sentinel Creek area but could see no source. No dust was visible. A helicopter check soon after also could not locate source area or impact."

2001062201 Sentinel Rock Sentinel Creek RF Summer 6/22/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "22 June 2001, 10 am, west of Sentinel Creek. Two visitors observed the rock fall and reported it to Valley District rangers. I [Snyder] suspect that both the 17 May and 22 June rock falls came from the large area of till on the steep shoulder west of Sentinel Creek which has produced a number of rock falls and then debris flows from that creek in the past. In the spring, this till is something of a reservoir for runoff and material is leached out of the older source areas in it."

2001070801 Grizzly Peak Sierra Point RF Summer 7/8/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "8 July 2001, morning, Vernal Falls Trail just below the 1986 rock fall impact [IDs 1986020701-1986021301]. A rock reported as the size of a washing machine or refrigerator came "lumbering" down the wooded talus to the trail and crossed to go down the other side. It was observed by a Yosemite Institute instructor. The rock was noisy as it came down the slope, though nobody heard any popping from the actual source. A man and his young daughter were on the trail. The young girl (6-8 years old?) was frightened and ran toward the boulder, actually running into it as it crossed the trail roughly 150 feet down trail from the lower end of the 1986 rock fall path. The young girl was scared, bruised, but otherwise unhurt. Mike Shenton tracked the source to a point about 50 feet east of the railing at Sierra Point."

2001070802 Glacier Point LeConte Gully RF Summer 7/8/2001 small

According to Jim Snyder (written commun. 27 November 2001): "Linda Eade and Mike Osborne heard this rock fall with rain from their home at the foot of Indian Canyon. We could locate no source area for it but the west side of LeConte Gully is a very likely location. They have heard enough rock fall from their home to have a pretty good idea of the direction."

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2001072501 Three Brothers Middle Brother RF Summer 7/25/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "A rock fall from above the Folly, within the 1 March 2000 source area east of Middle Brother (ID 2000030101). Merry Braun of SAR saw it from her tent in Camp 4. She woke her husband Werner Braun up and he felt the impact of it. The rock fall made a lot of noise and raised quite a bit of dust as it hit other horizontal joints with dry dirt and rock left over from the 1 March 2000 source. Checking with the Questar and using a photograph of the source last year, I [Snyder] could see the plate that had fallen. It did not leave very many scrape marks. It was a thin plate from the east side of the source, east of a large clump of hanging roots left from the earlier, larger rock fall. The rock fall lasted over 20 seconds. The plate that fell was probably 3-5 cubic meters in size. With so much vertical fall, it couldn't help but be noisy."

2001072701 Glacier Point Happy Isles RF Summer 7/27/2001 medium

According to Jim Snyder (written commun. 27 November 2001): "Mark Fincher of the Wilderness Unit observed this rock fall from near Nevada Fall. A trail crew at Mirror Lake heard and saw the rock fall and thought it came from the 1996 Happy Isles source. Fincher's perspective was better, however, and he was able to see that it came from a little south of the Happy Isles source, near the south edge of the huge prehistoric source that created the ridge behind the Nature Center. Mark could not see a source, but he was able to mark the track of the fall on a photograph. Fincher thought the rock fall amounted to "about the size of half a house" in quantity. It landed on the talus cone also hit by Blocks C and D in 1996 [ID 1996071101 and 1996071102]. The rock fall did not reach any facilities, although trails and roads in the area were checked for damage."

2001080201 Tioga Pass Lee Vining Canyon DF Summer 8/2-8/2001 very large

From the Reno Gazette (18 August 2001): "On steep Tioga Road in Lee Vining Canyon [just east of the eastern boundary of Yosemite National Park], at a large gully below a talus slope, 10 'landslide' events [at least two separate sources trapping cars between] were triggered by thunderstorms. About 7,000 cubic yards of debris was deposited on the road; the thickness of deposits on the road was 20 feet thick with some boulders up to 10 feet in diameter. The road was reopened on 17 August 2001."

2001081501 Glacier Point Ledge Trail RF Summer 8/15/2001 small

According to Jim Snyder (written commun. 1 November 2001): "At 9 am Wednesday, 15 August 2001, YCS Curry Village employee Joe Florida heard a pop or bang above him on the cliff. He looked up above the Ledge Trail to see a block falling. He heard it hit with a loud explosion noted into the campgrounds and saw a dust plume rise. He saw a few rocks come over the edge in the vicinity of Staircase Falls but found no impacts in Curry Village. A medical callout simultaneous with the rock fall alert indicated the possibility of injuries. Valley District rangers responded, finding no rock fall damage or injuries. The rock fall was noisy and raised a dust cloud on the big ledge above Curry Village and Staircase Falls. As Linda Abbott's photograph shows, rock fall impact sent dust down the ledge while rising warm air and impact also carried dust into LeConte Gully. Dust and viewpoints close under the ledge made the source difficult to locate from the ground. ... A reconnaissance flight with the experienced eyes of Helitack crew leader Karen Kufta enabled us to locate the source and check the rock fall track. We saw no sign of people on the ledge in the impact area. That afternoon we checked the talus behind Curry Village and discovered that rock fall and flyrock had reached about 600 feet away and 250 feet elevation above the nearest Curry Village accommodations. We were unable to find any new rock on the ledges of Staircase Falls. Further rock fall was reported by a geological tour group led by U.S. Geological Survey King Huber at 3 am, 16 August 2001. Though a location could not be determined, the new Ledge Trail source was the most likely source, for there was some loose rock hanging just below the new source. On 21 August we checked both the Curry and Ledge Trail source areas, finding no new cracks or signs of movement."

The failed sheet is in the shape of a backwards "L" outlined in the appended photograph. Proportional to the helicopter, the size of the source's bottom panel was roughly ten feet high, fifteen feet across, and two feet thick. Using this rough gauge to estimate remaining source areas, the total source can be calculated at about 17 cubic yards or about 40 tons. Fresh dirt at the top of the source suggests the presence of a weathered overlaying plate. Thickness of all these plates appears to have been 2-2.5 feet, though there may have been thicker bulge toward the source top. The overlaying slab was weathered at the edges and underneath. Possibly, it failed first, triggering the failure of the large sheet beneath it. Beyond this, no trigger for this rock fall can be determined. The backwards "L" frames a large plate roughly ten feet square and two feet thick--approximately 7.5 cubic yards or 17.5 tons. Several old longitudinal cracks run through it. These cracks have some vegetation in them and seepage has left stains of caliche issuing from them. No fresh movement, shear, or chipping along these cracks is apparent. Nevertheless, when the foundation of a sheet is removed by rock fall, the possibility for a later failure above the new source can be increased. If this remaining slab does fall, it will be smaller and follow the same track as the 15 August failure. It will be noisy and dusty but should not endanger any part of Curry Village. [for descriptions of the future failures at this site, see the 14 September 2001 and 25 September 2001 events listed as ID 2001091401 and ID 2001092502]. Whatever the trigger may have been, the failed slabs scraped their way down a very steeply inclined ramp 30-40 feet long before free-falling to a small buttress at the foot of the cliff face. There they exploded on impact, clearing out a little less than an acre of vegetation. Some rock remained in the area of impact, but much of it flowed down three parallel paths on the ledge, taking other loose rock with it. The ledge has several furrows, weathered vertical joints, which drain the ledge but also support a thin forest of live oak. Shattered rock bounded down these naturally weathered paths along the ledge. One joint furrow closest to the cliff becomes a gully which makes a turn around the edge of the open cliff to run toward the Knob Hill showerhouse at Curry Village. This gully has been the source of numerous debris flows, sometimes rock fall-driven, impacting the showerhouse in February 1986 (ID 1986021801). The showerhouse was rebuilt and a diversion wall above it made with debris-flow material. Swift-moving rock fall cut down many live oaks and one tall fir, while locking loose other debris on the ledge. Some rock stopped above and on the ledge. A few pieces made it around the gully turn and down toward the showerhouse. Some rock also crossed the gully at the turn. One block about five feet cubed left a clear track through the woods before coming to rest in the big talus about 600 feet above the Foster Curry cabin. This large block seems not to have come from the rock fall but to have been hit and sent down the mountain by it. Rock from the rock fall loosened much of the eastern wall of the gully with impacts, initiating the movement of many other rocks, and destroyed some of the remaining old Ledge Trail at the gully crossing. An enlarged topographic map section shows source impact and rock fall extent."

2001091201 Indian Canyon Church Bowl RF Summer 9/12/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "YCS Executive Administrative Assistant Carol Bjorgum heard rock fall and saw where it came from [near Church Bowl]. Carol lives on Ahwahnee Row, in a good position for observation of this cliff. She called the rangers about the rock fall, but I [Snyder] was unable to locate a definitive source area. rock fall did not reach the foot of the talus."

2001091401 Glacier Point Ledge Trail RF Summer 9/14/2001 medium

(1) According to Jim Snyder (written commun., 1 November 2001): "On Friday night, 14 September 2001, rock fall occurred about 10:45 pm followed by a larger, noisier rock fall at about 11:45 pm, lasting nearly a minute. The second rock fall awakened many in Curry Village and the campgrounds, but darkness precluded seeing anything. Rangers and Curry Village personnel checked the area behind Curry for fresh rock. They saw dust but found no fresh rock and heard no further rock fall. Therefore, they decided it was safe enough to leave the facility open. ... There is no indication of a possible trigger

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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for this event. No new or widened cracks or weaknesses were outwardly visible following the 15 August 2001 event (ID 2001081501). However, that first event must have stressed or destabilized material around it, for the second source nearly surrounded the first. The slabs that failed on 14 September abutted the 15 August source and nearly surrounded it. Though calculations are very crude, the 14 September rock fall appears to have been roughly three times the area of the 15 August source, or in the range of 120-150 tons. Most of the newly failed slab was thin - two or three feet through at the most - but the upper west side of it may have been as thick as six feet. This upper west side, framed by a local joint pattern, was also more weathered and dirtier than the rest of the unusually clean and bright source. No seepage had been visible in the source, and there had been no rain before this source during this unusually dry season. The 14 September failure generally followed the pattern in falling established in the 15 August event. There were some significant differences, however, especially that larger rock traveled farther and apparently faster on 14 September, and that some rock jumped the ledge between the gully and Staircase Fall. It is likely that the 15 August event cleared the track along the Ledge Trail for its 14 September successor. Most rock on 14 September took the several deeply weathered vertical joints on the ledge. Live oaks, some pines, and some obstructing rock from earlier rock falls have been removed or destabilized, affording less resistance to this latest rock fall. On 14 September, some rock went over the ledge about half way between the gully and Staircase Fall, where a thick forest with deeper duff tended to absorb it. A few pieces of this rock reached to within about 425 feet of Tent 67 and CV90A-B west of the gully. Most rock, however, traveled down the weathered vertical joints to the gully itself. There some of it had piled up. Other rocks bounded across the gully to head east, a few two cubic foot blocks getting as far as the talus above the Foster Curry Cabin, a hundred feet or more below the farthest rock there from the 15 August rock fall. On 14 September, quite a few pieces of rock slammed into the gully wall at the gully's turn around the eastern end of the broad ledge, where the old Ledge Trail used to cross the gully. Rocks of up to ten tons, formerly parts of the gully wall, were knocked out and sent down the channel a few feet. Impacts from the new rock loosened much of the channel and added to quantities of rock moving downhill. But the new rock was moving fastest. Some of it was bounding down the gully toward the showerhouse, cutting off 8-inch thick big leaf maples 15 feet in the air 500 feet above the showerhouse. With each impact, these blocks broke up a little more and showered the area within 50 feet of impact with smaller flyrock. The lowest group of large rock came to rest in the gully channel about 330 feet above the showerhouse. A single rock of about half a ton cartwheeled past this point, taking about 25 feet with each bounce until it dug into an old trail to former tent platforms 75 feet east of the gully, about 85 feet above uppermost tents 69 and 70, and about 160 feet above the showerhouse. The breaking up of the thin falling plate, then its rush along previously opened tracks, probably made possible such a long run toward the Curry Village tents. The gully guided much of the falling rock, but the rough character of the channel acted simultaneously to retard and hold most of the large moving fragments. It could be that the bedrock of the big ledge, little cluttered with talus, acted to accelerate material falling in the first two rock falls. It is interesting that such relatively small events could send material so far downslope by a circuitous path. The tracking of rock fall from the Ledge Trail is clearly quite different from tracking rock fall from Curry Village source where the long, lower angle talus cone beneath the source area greatly slows rock fall progress." (2) Guzzetti et al. (2003) mapped and modeled this rock fall.

2001091402	Glacier Point	Ledge Trail	RF	Summer	9/14/2001	See ID 2001091401
See ID 2001091401						

2001092501	Panorama Cliff	Panorama Cliff	RF	Fall	9/25/2001	small
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According to Jim Snyder (written commun. 4 October 2001): "An unusually active, fast moving thunderstorm system moved across California Monday and Tuesday, 24-25 September 2001. The storm arrived in Yosemite about 1 am September 25 and continued energetically until morning. About 0.30 inches [0.76 cm] of rain fell, occasionally hard. The lightning storm generated some 27 new fires while the rain cleared the air from the old ones. The storm initiated at least two rock falls heard about 4:30 am, one from the Panorama Cliff above the Nevada Falls Horse Trail and another from the new source over the Ledge Trail above Curry Village.... Campers, Curry Village guests, and employees alike heard the rock fall but could not clearly place it. ...With help from SAR, the trail was closed at 1:45 pm until sufficient trail crew personnel could return to man closures at Register Rock and Clark's Point.... The rock fall emanated from a cliff just below a steep-slope ledge and the 11 August 1999 source area [ID 1999081101]. That rock fall had been larger and had damaged the two switchbacks of the horse trail at Valley View severely. This latest rock fall was much smaller, capable of rapid cleanup with little rebuilding. Kim Orr's trail crew cleared the trail on Thursday, 27 September, so it could be reopened after two days of observation of the source for safety. The rock that hit the trail was smaller than the earlier rock fall, one to two cubic foot pieces with just a few slightly larger blocks. About 300 feet of trail was littered with rock, but only about eight feet of outside wall needed work.... As it turned out, this rock fall had included several sources, not all clearly visible. ... The latest source was about 950 feet above the trail switchbacks. This source was roughly 16% the size of the 1999 source and included between 6 and 9 cubic yards of rock weighing 14 to 21 tons. Like the 1999 event, this rock fall fell part way, then shattered on the cliff face which acted to spray broken rock widely over the trail. The 1999 event removed many protective live oaks and maples, leaving the path more open for the latest rock fall. Examining the source with the Questar from several different angles over a couple days gradually produced information on how this rock fall happened. A pine tree had rooted and grown in the space between two clearly defined vertical slabs above a weathered horizontal joint. Judging from large and small roots in the new sources, the pine tree had penetrated these slabs and had extended its roots in all directions for nutrient. Toward the thinner outer edges of the largest slab there were old cracks, some of them along joint planes. The roots were having greatest effects in these areas. The source area is shown in an appended illustration. The trigger for this rock fall was the storm of 25 September; however, that does not explain how the rock fall happened. The source pattern with the sudden rain may offer an explanation, which would go something like this: After a long, very dry season, the first rain came with a rush. Rainfall totals were only about 0.30 inches, perhaps closer to 0.50 inches in some locations during the thunderstorms, all in the space of three to four hours early in the morning. Less than 50 feet above the source is a large sloping ledge covered with grass, holding a number of large blocks from the 1999 rock fall, and dipping sharply north and east. Rainfall ran off the cliffs as well as off this steep ledge which acted as a small catchment basin. Could the sudden filling of closed joints behind the remaining slabs at this source have exerted enough pressure pushing out that the thin, root-penetrated edges of the slab buckled and fell? Such an explanation can account for both the timing and the pattern of sources around the tree, but such an explanation can only be tentative."

2001092502 Glacier Point Ledge Trail RF Fall 9/25/2001 medium

(1) According to Jim Snyder (written commun. 1 November 2001): "An unusually active, fast moving thunderstorm system moved across California Monday and Tuesday, 24-25 September 2001. The storm arrived in Yosemite about 1 am 25 September and continued energetically until morning. About 0.30 inches [0.76 cm] of rain fell, occasionally hard. The lightning storm generated some 27 new fires while the rain cleared the air from the old ones. The storm initiated at least two rock falls heard about 04:30, one from the Panorama Cliff above the Nevada Falls Horse Trail and another from the new source over the Ledge Trail above Curry Village. ... Campers, Yosemite Institute groups at Curry Village, and employees all heard the rock fall. Because the rock fall occurred at 04:30, no one could see where it

came from, though it was clear nothing reached Curry Village itself... The third failed slab, hanging below a prominent weathered diagonal joint, was probably weakened by the 14 September source [ID 2001091402] beneath it. The 25 September rock fall was obviously triggered by the sudden rainstorm after a very dry season. The third failure was not as large in area as the second, but the third consisted of a much thicker slab producing larger blocks in the rock fall than either of the previous two events. The third slab seems to have been up to six feet thick. Only a crude estimate of size is possible. The third failure looks about two and a half times the size in area of the 15 August source (ID 2001081501) but the third failure was a much thicker slab. It was probably in the vicinity of 125 cubic yards or just about 300 tons. Some splinters remained from the breaking away of this third rock fall, especially on the west edge of the source. The new roof along the large diagonal joint is clean. It is not possible to tell when or in which direction this source might progress. There is no indication of widened or new cracks or joints in the massive cliff surface west of the Ledge Trail sources. That cliff appears stable for the foreseeable future, but as these three rock falls have shown us, that can change overnight or within the flash of a lightning bolt. It appears that the same diagonal joint pattern controlling the roof of the Curry Village rock fall is also a contributing factor in the roof of the Ledge Trail rock fall. In the three Ledge Trail rock falls, failures have worked up to that defining joint but not beyond it. Meanwhile, smaller diagonal joints dipping west and a vertical joint set seem to have defined much of the first two rock falls. Those initial rock falls removed the underpinnings of remaining material which was both thicker and more weathered behind. This third rock fall, though the largest, sent material downslope only as far as the 15 August event had. Some rock jumped the gully wall and proceeded east toward the Foster Curry cabin talus, reaching about 50 feet further than the 15 August rock fall had. In the main gully, several blocks made it as far as those furthest downslope in the 15 August event. No rock from 25 September went beyond the gully to the west as 14 September rock had. Distributions of rock from the three rock falls are shown on an accompanying topographic map section. The 25 September event produced the largest sized rock of the three rock falls. The lowest blocks from this rock fall were at least two times the size of those from the earlier events. The size and distance of these three rock falls do not match the usual patterns. The second largest rock fall (14 September) traveled farthest, while the largest reached only as far as the first or smallest rock fall from the Ledge Trail source area. One distinctive difference between the pattern of fall from the Ledge Trail sources and the pattern of other rock falls is that the Ledge Trail sources do not follow a more or less direct path. The Ledge Trail sources we know of have always been directed by the broad ledge and the gully and weathered joints draining it. How open or blocked the paths along this ledge may be can easily affect the progress of rock fall... But the greatest impacts to the gully occurred on 25 September, when larger rocks had larger impacts and moved some of those accumulated at junctions and turns farther downslope, loosening and rearranging the gully walls in the process. One large boulder of about 10 tons at the gully turn was loosened and moved about 10 feet 14 September. On 25 September, however, that boulder was hammered and sent down the gully nearly 200 feet further, stopping just above the farthest extent of the 15 August and 25 September rock falls."

2001101001 Glacier Point Curry Village RF Fall 10/10/2001 extremely small

From Jim Snyder (oral commun., 29 October 2001): "As reported by a Yosemite Institute observer, a small rock slab (2x3x.5 feet) fell from the face of the previous 29 August 2000 Camp Curry source area."

2001103001 Three Brothers Middle Brother RF Fall 10/30/2001 very small

According to Jim Snyder (written commun. 27 November 2001): "Shelton Johnson, National Park Service Interpreter, got off the commute bus and was walking across Swinging Bridge, when he saw a couple pieces of rock coming down from Middle Brother through an opening in the low clouds. The rock fall

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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lasted 4-5 seconds. We could not find any impact in the lower talus; nothing reached Northside Drive. We could not locate a source area."

2001111201 Glacier Point Staircase Falls RF Fall 11/12/2001 small

According to Jim Snyder (written commun. 19 November 2001): A number of people heard the rock fall at 21:50 on 12 November 2001. Across the valley residents thought that Indian Canyon was coming down. Some staying at Curry Village worried that the rock fall was above them; a few left the park. The rock fall fell with a loud noise followed by a rumble, according to one Curry Village guest, but it did not last long. There was no evidence of anything reaching Curry Village, so there were no evacuations or closures. There had been a storm that Monday which started warm in the afternoon but quickly dropped in temperature to leave snow on the valley floor by about 18:00 on 12 November. The bulk of the storm was over by 22:00 when temperatures and snowlines began to rise. Yosemite Valley received a total of 1.47 inches [3.73 cm] of precipitation in a fifteen hour period, but the greatest amount of precipitation was 0.97 inches [2.46 cm] between 3 and 6 pm, 12 November. The cliffs were wet with running water through many joints the next day. The Curry Village and Ledge Trail source areas were mostly wet and showing some internal seepage. Because visibility was obscured by early mist, I could not check the Curry and Ledge Trail sources with the Questar until late morning, 13 November. No changes were apparent in either source. Scanning the cliffs for a new rock fall, a new source quickly turned up west of the Ledge Trail, Curry Village, and Staircase Falls. The source was from about 5,000 feet elevation, probably just under the line of maximum extent of the Tioga glaciation at that point on the cliff. A thin slab roughly 30 feet long, 12 feet high on the east side and roughly 6 feet high on the west, up to about 2 feet thick but often quite thin, had failed. The failed slab appears to have been between 10 and 15 cubic yards in volume and between 24 and 35 tons in weight. The failed slab appear to have been two thin vertical slabs partly weathered through at its east end. The failed slab had no attachments behind. Its major attachment was on the shorter west vertical break, though some fresh rock indicated there were a few remaining attachments along the east vertical break. The source was easily spotted because it was one of the dirtiest I've seen. Mud and dirt covered the source except for the vertical break on the west side. A line of live oaks had grown from a horizontal joint delineating the top of the failure down into the vertical joint behind the slab. A few of these small trees had fallen with the rock fall; at least one small tree was hanging upside down in the source. Mud and dirt covered the cliff in a 200-foot-plus long wash below the source. No doubt the next storms will wash most of this away. The source lies immediately above a small roof, so the failure started with a short free-fall. None of the source reached the valley floor, however, and none of it came dangerously close to Curry Village. No ice was visible in any of these sources on 13 November or 19 November, although temperatures at the source have probably been around 32 degrees [Fahrenheit] several times recently this fall. It seems clear that the 12 November storm triggered this source, but the appearance of the source may suggest more detail about the process of failure. For one thing, the vertical joint behind the slab and parallel to the cliff face was completely weathered through. There were no attachments at the back. The eastern vertical break was clean, showing it had been the major support. It appears, then, that the dirt behind the slab became heavily saturated with runoff from this storm. The saturated earth exerted a pore-water pressure against the weak overlying slab, pushing it out just enough to break the minimal attachments on the east end and then the thin but last major attachment on the west. The rock fall was followed down the cliff by a slurry of mud from behind the source.

2001112501 Merced River Gorge El Portal Road / Arch Rock RF Fall 11/25/2001 small

According to Jim Snyder (written commun. 27 November 2001): "A ranger at the Arch Rock entrance station heard and saw the rock fall from the top of the cliff. It was a large slab, and he was worried about the safety of the entrance station. The rock did not make it all the way down the talus slope,

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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however, and there were only a few fragments on the road. The road was closed because nobody could see where the rock had come from and did not know how safe reopening would be. The rock hit about 300 feet west of Arch Rock entrance station. Above that point is a high alcove in weathered rock, much of which is loose and appears castellated from the road. The source area was in this area. I could not see a track through the brush on the talus slope, so most of the rock stopped well short of the road. There is no size estimate, but I [Snyder] estimate that what fell was in the 20-40 cubic meter range. The talus is high but not overly steep, and it is well vegetated. What fell was not big enough to make it through to the bottom in quantity."

2002032501 Grizzly Peak Grizzly Peak RF Spring 3/25/2002 very small

According to Jim Snyder (written commun. 25 March 2002): "A small rock slide occurred from the north side of Grizzly Peak, not affecting any trail. Drizzle had occurred on 23 March with freezing night temperatures."

2002050001 Cathedral Rocks Middle Cathedral Rock RF Spring 5/n/a/2002 small

According to Jim Snyder (written commun. 1 October 2003): "On the Internet, Google, Groups, rec.climbing, there were reports of rock fall in the Cathedral Chimney, which is a deep, steep, loose gully between Middle and Upper Cathedral Rocks. Climber Joe Collins reported having used the Cathedral Chimney for a descent on 12 May: 'The rock fall in the Cathedral chimney is obvious: large boulders as well as dust and rock fragments.' Two other climbers in the chimney during May had been narrowly missed by football and grapefruit-sized rocks coming down from above. One climber mistakenly thought this rock fall in the chimney had caused artist Steve Lyman's death in 1996. The loose rock from 2002 rock fall in the chimney did contribute to a climbing accident in 2003, when a climber loosened 'a large, detached block, perhaps half the size of a refrigerator.'" (American Alpine Club, 2003)

2002052001 Merced River Gorge El Portal Road / Dog Rock RS Spring 5/20/2002 small

(1) According to National Park Service Morning Report, Wash. Office (written commun. 22 May 2002): "A rock slide occurred within the park around 6 p.m. on the evening of Monday, 20 May. The slide occurred along the El Portal Road (Highway 140) approximately one half-mile east of the park boundary near Dog Rock. A slab of granite approximately 12 feet in diameter sourced roughly 1,000 feet above the road. There was significant damage to the road and to the rock wall. The entrance into the park at Arch Rock, along Highway 140, was closed until noon yesterday, but Highways 41 and 120 remained open. There were no injuries." (2) According to Jim Snyder (written commun. 1 October 2003): "A jailer saw the boulder come down to the road following a heavy rain. The boulder was about 12' in diameter and 8' high sitting in the outer lane of the El Portal Road. An assessment of the rock fall was made by Tim Ludington the morning of 21 May. He thought he found the source area about 1,000 feet above the road, but did not map or photograph the location. It is not clear whether the rock came from the sheer cliffs above the impact or from the talus. Either is likely though the rounded shape of the rock might suggest talus dislodged by the heavy, cold storm. I [Snyder] was unable to locate a source area from the road area. There was an impact point on the wall but only light impact on the road. The impact seemed too light for a 1,000 foot fall to me."

2002052101 Sentinel Rock Sentinel Creek DS Spring 5/21/2002 small

According to Jim Snyder (written commun. 1 October 2003): "Valley Patrol Ranger Jack Hoeflich was on a SAR at El Capitan Meadow when he heard rock fall near Sentinel Creek and Rock. He thought it lasted about 30 seconds. Grady Bryant and I [Snyder] checked for source areas in the Sentinel area in the morning of 22 May. Former rock fall source areas in the Sentinel Falls area still had snow on them. But a rock fall area just west into what is sometimes called 'Little Sentinel Creek' was missing some snow

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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and showed a pretty good slide running along a diagonal plane to the creek channel, where it piled up. There were new abrasion marks along the cliff to the talus on the Valley floor. This may have been more debris flow than rock fall, since it came not from cliffs but from weathered, poorly consolidated material that has produced other rock falls. This event also followed the heavy storm of 20 May. There is no size estimate for this rock fall, but it was not very large, perhaps in the range of 100 tons or so."

2002052701 Cathedral Rocks Middle Cathedral Rock RF Spring 5/27/2002 small

According to Jim Snyder (written commun. 1 October 2003): "[Rock falls on] Middle Cathedral Rock, [near the] 'Katwalk', shortly before 27 May 2002, then again on 27 May, about midday. This rock fall was on a climbing route and was reported by rock climbers to the National Park Service as well as being posted on the Internet on Google, Groups, rec.climbing, which I [Snyder] copied on 4 June 2002 and quote the relevant passages: 'We hiked up to the Katwalk, and traversed along it, until things started to get strange. There was a big slide area in the forested trail section, 300 feet from the Cathedral Chimney descent gully, but no obvious source of rock fall. Further along, the leaves were covered with rock dust, and we saw there had been a massive rock fall in the gully. Pulverized rock was everywhere, and no vegetation was left in the gully. The gully was deep in unstable, dirty/dusty talus. The rock fall was very fresh and had come from further up the gully, where I recall there used to be some giant chockstones. . . . we heard the sounds of rock fall from far above. I stepped up to a vertical section right on the rap anchors and tried to make myself small under my little pack. The rocks (1-2 feet in diameter?) missed me, but after a few seconds delay we heard a bigger rock and clearly deadly (3-10 feet in diameter?) cut loose. Apparently it had been tipped over by the first rock fall, and now it thundered and crashed down the gully, bringing other large rocks down with it. I yelled to Dennis that big rocks were coming down, "WATCH OUT!!!" I didn't try to look at this one, but as it started slow, it seemed to be coming more down the center of the gully, and was not flying as randomly as the first one. It crashed by and I [reporting party] was not hit. [No one in the party was hurt.] There was no further rock fall, and we hurried down as fast as we could. When we got back to the car, we drove to Camp 4 and left a message about the rock fall on the bulletin board.'"

2002061701 Cathedral Rocks Middle Cathedral Rock RF Spring 6/17/2002 small

According to Jim Snyder (written commun. October 1, 2003): "An additional rock fall from Cathedral Rocks, on 17 June 2002, about 1:20 pm. Jim Tucker and Mark Fincher saw the source area, a big dirty spot [on the cliff face]."

2002071001 Glacier Point Happy Isles RF Summer 7/10/2002 small

According to Jim Snyder (written commun. 20 July 2002): "On 10 July 2002, I [Snyder] was with Park Interpreter Marea Ortiz and a group of 45 park visitors on an interpretive walk to Vernal Fall on the Merced River. At 10:27 am, we were on the lower steps of the Mist Trail when we observed rock fall from the cliffs about 1.1 miles west and above Happy Isles. There was a low, thunder-like crack, then dust and a long dribble of broken rock off a large, sloping ledge onto talus. Two separate rock falls were reported to Park Dispatch. Initially we could see only one source because dust obscured our visibility. The second rock fall point was plainly visible the next day with a Questar telescope. At 7:20 am on July 11, I [Snyder] examined the Happy Isles cliff and talus with the Questar telescope. Two rock fall sources were clearly visible on the same cliff face about 50 to 75 feet apart. Fresh abrasion marks, removed vegetation, freshly broken rock and old dark seepage lines all helped to determine the rock fall sources and paths from an elevation of about 5,400 feet. By comparing the source area with the scale of nearby vegetation, I made crude estimates of the source areas and thickness of these rock falls. The larger and higher source was triangular at its top, approximately 50 feet high and 50 feet across and approximately two feet thick at the top but tapering to nothing on its right side. The bottom of the source was a long,

thin plate about 50 feet high and 25 feet high and 25 feet wide but averaging only six inches in thickness. This rock fall sourced approximately 164 tons (69 cubic yards) of material. The smaller rock fall below and left of the larger also involved a thin sheet of an irregular shape with an approximate surface area 25 feet square. This second failure looked thinner at the top than the larger failure, perhaps a maximum of 18 inches thick, and tapered to nothing along edges and bottom. A rough estimate of the size of this source was about 41 tons (17 cubic yards). Many other rock fall source scars are visible in the vicinity of these two sources. An irregular scar on the left side of this source looks fresh at first but appears older on closer examination. Along the lower edge of the triangle of the first source, ... is a wide band of white rock. Thin joints appear to exist between that band and the rock above and below it. A joint also defines the right edge of the triangle. Very light and slow but visible water seepage was observed on 11 July issuing from the points of intersection of these joints. There was no visible seepage in the smaller source. However, both sources showed dry, discolored (light brownish) drainage stains on the freshly exposed rock underneath the top edge of the sources. There were no visible roots or vegetation remaining in the sources. There was a freshly broken live oak bole and roots on the large, sloping ledge beneath the sources, but this tree probably came from impacts below the sources themselves. Both rock falls fell vertically a short distance from their sources, landing and breaking up into smaller pieces of rock on a steeply inclined plane ... That plane leads to a large buttress which has been heavily battered by previous rock fall from the top of the Happy Isles cliffs, including the 1996 rock fall (IDs 1996071101 and 1996071102). This buttress caught much of the disaggregated rocky debris fragments of these current rock falls. On 10 July 2002, for example, we watched the dust rise from the buttress much more than from the talus below. The buttress also funnels most rock fall debris in the area to the top and right side of the talus cone beneath it. The total distance from source to the terminus of deposit is approximately 3000 feet, horizontal map distance. No facilities were affected by these rock falls. There was no clearly distinguishable trigger for these rock falls. There had been no rain since 31 May 2002. Subsurface seepage observed from a number of cliffs had dropped off sharply in the month previous to these rock falls. Peak snowmelt was early this year with several spring heat waves rapidly reducing the 95%-of-normal snowpack. Freeze-thaw was therefore not a possibility for a trigger, and pore water pressure from infiltration of rain or snowmelt seems unlikely as well. No significant earthquakes were felt or recorded on the day of the rock falls. Absence of roots in the sources suggests vegetation also did not contribute to the failures. The face of this part of the cliff where the rock falls sources, however, is distinctive in that it is an alcove cut slightly under the cliffs above and visibly oversteepened in both photographs and topographic maps. The thin slabs free-fell from their sources. The impacts several feet out from the cliff face were clearly visible with the Questar as was the small vegetation remaining unimpacted in the joint between the cliff face and the sloping ledge of impact. The cliff face of the two rock fall sources is certainly at an angle of over 90 degrees at this point. Unlike the cracking formation at the rock fall source over Curry Village, which rests on a cliff face of about 70 degrees, these new failures were quite literally hanging over open space. The cliff face in this alcove may have avoided impacts during the third and fourth rock falls of the 10-11 July 1996 sequence because this face was recessed. Formation of this alcove in conjunction with the orientation of joints on this cliff face set up the geometric configuration contributing to these failures. The alcove serves as a conduit for surface and subsurface intermittent drainage from the small watershed above the 1996 Happy Isles source. The alcove is just north of another drainage from the rim that produces an ephemeral waterfall in spring. On the east-facing side of Glacier Point, there are many sets of joints that daylight with seepage and sometimes high quantities of flow, especially in the spring. Many of these daylighting joints come from and below a very large ledge or bench which was the source of a huge prehistoric rock fall at Happy Isles.... Some of the weathering and long term geomorphic development of this recess has therefore been due to water-and ice-related processes of freeze-thaw and increased pore water pressures that initiate rock falls. Perhaps more important is the fact that the new sources

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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are at or not far below the line of maximum extent of the Tioga glaciers 20,000 years ago. This rough line is determined by comparative weathering in cliff profiles along with the presence of vegetation in more weathered, receptive rock, among other things. This oversteepened alcove may have begun as a product of glacial scouring and plucking in weaker rock, while stronger rock below it in the buttress and to the north in the long Glacier Point Apron resisted glacial erosion more successfully. The alcove has been modified by later surface and subsurface runoff along with freeze-thaw; however, this cliff recess seems too large, too pronounced a feature to have been caused by small intermittent seeps and drainages alone."

2002071002 Glacier Point Happy Isles RF Summer 7/10/2002 small

See ID 2002071001.

2002100201 Tenaya Canyon Mount Watkins RF Fall 10/2/2002 medium

(1) According to Jim Snyder (written commun. 21 January 2003): "Report of a rock fall in the vicinity of Snow Creek Falls-Watkins Pinnacles: heavy rain on previous day (11am-8 pm) closed all high roads. The trail crew on Half Dome reported a big dust cloud while the rock fall kept rumbling for a while. On the photograph, the source is approximately square ... about 122 feet square. The plate that fell was pretty thin. The photographs don't show much of an edge, and I didn't see much of a lip around the source when I was out there in October either..." (2) According to Oldrich Hungr (written commun. 16 December 2002): "I [Hungr] would say that the rock fall was a bit over 50 cubic meters. I could see large individual blocks rolling through the cloud, just before I took the first picture. There was some light rain the preceding night, with some 1-2 inches of rapidly melting snow on the Half Dome in the morning. Everything was pretty well dry by the afternoon."

2002110701 Sentinel Rock Sentinel Rock DS Fall 11/7-9/2002 medium

According to Jim Snyder (written commun. 20 January 2004): "The fall, 2002, debris slide is a report from Jose Lopez (Acting Trail Supervisor). This slide occurred 7-9 November 2002 during an intense rainstorm, the first real storm of the season, which had precipitation records as follows: 6 November, 0.23 inches [0.58 cm]; 7 November, 3.44 inches [8.74 cm]; 8 November, 3.70 inches [9.4 cm]; 9 November, 0.22 inches [0.56 cm]; and 10 November, 0.06 inches [0.15 cm]. This heavy precipitation unloaded part of a steep gully on the west side of Sentinel Rock. Rocks on average were 3-4 feet in diameter with a few larger. These rocks crossed the Four Mile Trail above the westernmost switchback corner in a place that had been rebuilt more heavily to sustain the impacts of frequent movement of rock through this area. This is the same area of impact as ID 1985100701. Jose Lopez estimated the amount in the trail area to be 200-300 tons, or about 127 cubic yards. Perhaps a total volume of 200 cubic meters would take more of the off-trail material into account."

2003050501 Glacier Point Glacier Point Apron RF Spring 5/5/2003 very small

According to Bill Zaumen (written commun., May 2003, Google Groups, rec.climbing): A rock fall occurred on or near the Glacier Point Apron. Zaumen noted that "there was some rock fall Monday night, somewhere around the Apron. It was loud and went on for at [least] a good 10 seconds, but in the dark, and being half asleep when it started, I couldn't get a really good sense of where it was.... Temperatures were cool, it rained heavily late Tuesday afternoon, and even before that lots of routes were soaking wet..."

2003060601 Half Dome Half Dome RF Spring 6/6/2003 large

According to Jim Snyder (written commun. October 1, 2003): "The Half Dome rock falls came from the same source area on three occasions: 6 June, 19 June, and 29 June 2003. On 6 June, several climbers

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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were approaching the foot of Half Dome to begin a climb when blocks fell from the wall. They were a hundred yards below the foot of the wall when one of them stumbled and broke an ankle. None were hurt by the rock fall, but the individual with the broken ankle was carried out by National Park Service SAR. The 19 June 2003 Half Dome rock fall was heard by visitors at Mirror Lake, who also saw the dust. They did not see the source but their description placed it in the same vicinity as the events of 6 June and 29 June. The 29 June Half Dome rock fall was the largest of the three. Climbers observing it said a large plate sort of buckled and fell, passing over two climbers and pulverizing at the bottom. National Park Service Helitack flew the rock fall to check for injuries. Fire Guard Shawn Walters was on the flight and had also done some climbing in the area. He said the failed flake was very thin, 18 inches to 2 feet thick, and that the source was dry at the time of the flight an hour after the failure. The rock fall hit the sandy base immediately below Half Dome's face, and was pretty well contained at the base of the cliff, although a couple of pieces they could see from the helicopter traveled a hundred yards downhill. The failure took out the 5th pitch of a climb called "Kali Yuga," shown in Don Reid, Big Walls (Evergreen, CO: Chockstone Press, 1993), pp. 151, 158. Yosemite Valley ranger Dave Horne talked with climbers who had been on the Regular Northwest Face route not far away. They saw two climbers near the Kali Yuga and heard creaking sounds about 6 am. Knowing something was going to break, they called to the two climbers in warning. When the failure occurred, the two climbers were in a cloud of dust and new talus. They both survived and walked back to Camp Four covered with rock dust. Though it does not seem possible to say exactly how these failures occurred, the character of the source hints at the progression. A sketch of the source is attached. It appears that the bottom plate fell out first on June 6. There is a small source beyond a remaining triangular plate that may have produced the sounds heard June 19. That small source may have been occasioned by the shifting of the plate above the June 6 failure. That plate was defined partly by J2 joints and sat partly on a thin ledge formed by one of those joints. That ledge, dipping east, probably acted to send the failing plate a little east and helped account for the observed buckling of the plate. An estimate of size is difficult because of the great irregularity of the failures. A crude estimate using the visible face of Half Dome as a measure of the scar can give relative figures of source size. The face is about 2000 feet high at the point of the source, which makes the scar approximately 220 feet high by comparison, about 68 feet across on average, and 1.5 feet thick for the most part. The three failures therefore totaled about 831 cubic yards and 1964 tons of rock. The remaining triangular flake, which is freshly and clearly cracked all the way around, may be about 157 tons and 67 cubic yards in size. The flake appears to be resting on a thin ledge formed by another joint system. The flake also appears to have moved slightly west, probably pressuring the 29 June failed plate in the process or slipping a little as a result of that failure. The cracks around this flake are as clear and threatening as those in the source above Curry Village. Some of the cracks are also related to what appears to be the same J2 joint system on the Glacier Point cliffs. There is no way to discern a trigger for this series of rock falls. Staining in the new source shows that there had been seepage behind the failed flake long before it actually fell. The stain comes much of the way down Half Dome's face, running from Tissiack's mouth to the source itself, usually on the surface, but sometimes along a subsurface J1 joint. The stain was dry at the time of the failures. There had been no storms to contribute to the failures.

2003061901	Half Dome	Half Dome	RF	Spring	6/19/2003	See ID 2003060601
See ID 2003060601						

2003062901	Half Dome	Half Dome	RF	Summer	6/29/2003	See ID 2003060601
See ID 2003060601						

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2003071701	Panorama Cliff	Panorama Cliff	RF	Summer	7/17/2003	small
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(1) According to Jim Snyder (written commun. 1 October 2003): "At 12:03 on 17 July 2003, National Park Service Interpreter Joanna Cooke was standing at the Glacier Point amphitheater when she heard and saw a rock fall from Panorama Cliffs across the canyon. As she called the event in, visitors on the Nevada Falls Horse Trail also used cell phones to report an injured family at Valley View. An incident command was set up with Valley District Ranger Steve Yu in charge of the SAR Cache. Arrangements were made first for a medical examination of the victims, next for closure of the trail by signs and noncommissioned trail guards. A rescue team was on site by about 13:30. Mr. Guzman, 33, had been hit in the back of the head by a small rock, was in and out of consciousness, and had lost his sight. He was carried down by wheeled litter. Mrs. Guzman, 30, had a cut but no break on her leg. Their infant suffered minor abrasions. Mr. Guzman was flown to Modesto for surgery, and the others were sourced from the Yosemite Medical Clinic after evaluation and treatment. The Nevada Falls Horse Trail was closed, manned, signed, and taped at Clarks Point and at the junction of the Horse Trail with the Mist Trail. All foot traffic was routed by the Mist Trail. Roe, Ludington, Larry Castro, and Snyder flew the source to assess safety and trail repair. The source was dirty but nothing hanging. The resulting plan was to leave the trail closed over the weekend and to let thunderstorms clean off the cliff face (which happened in an hour's downpour the next afternoon), assess the trail damage on Monday 21 July, and begin work Tuesday 22 July. Trail guards assisted with the work closure, leaving the trail signed but unmanned during off-duty hours. The trail was reopened Friday 25 July. There had been no further rock fall from this source during the intervening period. Joanna Cooke saw no blocks in the rock fall, only dust stretching down the cliff toward the westernmost switchback corner called Valley View. What we saw shows the very great breakage suffered by the thin, weathered slabs as they hit the cliff below the source, free fell, then hit the cliff again, spraying over the trail switchbacks some 950 feet below the source. As visiting climber Runar Hoiom's photograph shows, the first impacting buttress turned the rock fall a little east, just up trail from Valley View. In this, the rock fall followed the pattern of its predecessors on 11 August 1999 [ID 1999081101, and 25 September 2001 [ID 2001092501]. The impact zone was roughly identical to the earlier rock falls. Impacts to the trail had been greatest on 11 August 1999. In this latest rock fall, the trail was covered with rock, soil, and a few trees with relatively little impact to the structure itself. A photograph taken during the assessment flight shows the 17 July 2003, source and its surrounding area. The source area appears to have been near or a little below the maximum extent of the Tioga glaciation 20,000 years ago. Thinner sheets formed by the joint system parallel to the cliff face at this point may account for the greater weathering of this source area than might ordinarily be expected beneath the glacial line. This source may also have been affected by rock from the 11 August 1999, rock fall which swept over the cliff edge at this point. One large white block remains near the lip to show the trajectory of that rock fall. The latest source was an extension of the storm generated 25 September 2001, Panorama Cliffs rock fall, although there was no storm or other clear trigger on 17 July 2003. The source area showed plenty of subtle activity, however. The source was a thin plate defined at the bottom by a major joint system, the same as the J2 system on the wall below Glacier Point and the same as the J2 system on Half Dome's face and showing in the June 2003, rock falls there [IDs 2003060601 -2003062901]. The J2 joint at the bottom of the source defined the bottom edge of the flake but provided little support for it. The failed section was actually two thin flakes, through both of which a small pine had sent its roots. Root clumps and dirt lay behind the failed flake along with some bigger roots from the pine. The source was not clean and bright but showed the distinct colors of weathering. Though the source was dry at the time of the failure, there is clear evidence of past seepage through it. A large sharply sloping ledge above the source is formed also by the J2 joint system. This ledge probably directs water toward the new source. A sketch of the source area and remaining flake [shows] subsurface seepage and surrounding blocks, nearly all related to the steep inclined planes of the J2 joint system. The large white block above the source remains from the 11

August 1999, rock fall and shows how much of that rock fall went over the cliff, possibly impacting the present source area. The photo also shows the J1 joint system - the system of joints parallel with the cliff face - and vegetation growing on it. Drainage down the inclined plane formed by J2 joints above feeds these vertical J1 joints a prominent source of subsurface seepage in the present source. The sizes of the three rock falls are not easy to calculate because of the great variation in slab thicknesses. ...The triangular slab remaining above the roof is approximately 7-10 cubic yards or 17-24 tons. This remaining slab appears attached at the sides but obviously has seepage flow occasionally behind it which continues to weather remaining connections. The slab will fail, though failure is more likely to be in years rather than months. Impacts will be comparable to the last two failures. The fact is that the slab is weathered and thin will mean much dust and great clatter when it fails. It will break up very much on its way down and will be sprayed over the trail by intervening buttresses on the cliff face." (2)

According to Jack Hoeflich, Valley District, reported by Inside National Park Service, Information Gateway for National Park Service Employees (written commun 23 July 2003): "Rock Fall Injures Family of Three Around noon on Thursday, July 17th, a ranger at Glacier Point reported by radio that a large rock slide and dust plume could be seen near Panorama Cliff. A short time later, Yosemite Park Dispatch received a cell phone call from a hiker on the John Muir trail just below the base of Panorama Cliff, reporting that there were at least three injured hikers, including a baby. On-duty rangers responded immediately from Yosemite Valley and Little Yosemite Valley. A multiple casualty team made up of search and rescue team members, rangers from both the Valley District and Tuolumne Subdistrict, and trail and forestry crew members responded to the scene. Injured hikers were about two miles up the trail. The initial responders found Rudy and Gwendolyn Guzman and their 21-month-old daughter in the rubble. About 250 feet of trail was covered with rocks up to four feet in diameter. Rudy Guzman reportedly had been struck in the back of the head by a basketball-sized rock. He was conscious, but extremely disoriented, and he could not see. Gwendolyn Guzman and the baby had received minor back and leg injuries. Rudy was placed in a vacuum body splint and transported down the trail in a wheeled litter. Gwendolyn and her daughter were transported together in another wheeled litter. The patients were met at the trailhead by ambulances. Rudy was transported to the Ahwahnee Meadow, and then flown by helicopter ambulance to Doctors Medical Center in Modesto. Gwendolyn and the infant were transported to the Yosemite Medical Clinic where they were treated and sourced later that day."

2003071801 Giant Staircase Mount Broderick RF Summer 7/18/2003 medium

(1) According to Jim Snyder (written commun. 1 October 2003): "At Mount Broderick three rock falls occurred on 18 July 2003 and one on 21 July 2003. These four rock falls were all observed by SAR trail guards Steve Stine and Brandon Latham, posted at Clark's Point for the trail closure above the 17 July 2003 Panorama Cliffs rock fall (ID 2003071701). The rock falls were noted, but it was not possible to distinguish between the different sources. There is no clear trigger for the rock falls, either. A torrential hour-long thunder storm occurred between 15:00 and 16:00 hours 18 July, well after the third Mt. Broderick event. The 21 July 2003 failure may have been a delayed result of that heavy storm. More rain occurred the next day, 22 July 2003. Yosemite Research Library negatives 298 and 2809 taken by Ralph H. Anderson on 30 June 1938, and 10 July 1942, respectively, show the cliff face before the failure. Those pictures show a bulging flake, quite thick on top tapering sharply toward its bottom. Anderson's photos also show live oak trees and bushes growing along the top of the flake. Comparison of the flake edges with those trees and bushes led to a size estimate. The top ridge of the flake varies from 10-12 feet thick to 15 feet thick. The source is about 30 feet high and close to 40 feet across. The total amount that fell in the series of failures from that source was, then, about 893 tons or 378 cubic yards of rock. The rock slipped out, hit a ledge below the source, then free fell about 400 feet to a bench covered with talus, which was in turn covered with a patchy forest of live oak and pine.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Anderson's photos show that there had been rock falls at this location before, and that the forest had been for some time growing back into an area opened by much earlier rock fall. The July rock falls cleared out that forest, leaving fresh talus. Much of the rock stopped on that talus-covered bench, but some went on down the next ledge to stop behind another growth of tall pines and mature live oaks. As rock passed over the lip of the first ledge, it took off another weathered flake of about 26 tons and 11 cubic yards. Altogether then, this series of four rock falls produced about 919 tons or 389 cubic yards of material."

2003071802	Giant Staircase	Mount Broderick	RF	Summer	7/18/2003	See ID 2003071801
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See ID 2003071801

2003071803	Giant Staircase	Mount Broderick	RF	Summer	7/18/2003	See ID 2003071801
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See ID 2003071801

2003072001	Glacier Point	Ledge Trail	RF	Summer	7/20/2003	small
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According to Jim Snyder (written commun. 1 October 2003): "The Ledge Trail rock fall of 20 July 2002, occurred at 23:40. Many people heard it, but, because it was at night, locations of the reported rock fall varied widely. Allen Kunz, who lives in the Indian Creek apartments provided the best location somewhere near the Ledge Trail, while others swore it was nowhere near LeConte Gully. Many thought it was from the Curry Village source. A thorough examination of the cliffs on 21 July eliminated the Curry Village source as a source, for there had been no change there in the previous week. Examination of the cliffs from LeConte Gully around the Glacier Point Apron isolated only one new source, and that was at the bottom of a series of three sources from August and September 2001. The failed plate was thin, roughly rectangular, and fell from the lower east corner of the earlier source scar. I [Snyder] don't have a size estimate but believe by comparison with the rest of the source area that the failure may have been in the vicinity of 50 tons or about 21 cubic yards. There was no discernible trigger for this event."

2003072101	Giant Staircase	Mount Broderick	RF	Summer	7/21/2003	medium
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See ID 2003071801

2003072201	Three Brothers	Middle Brother	RF	Summer	7/22/2003	small
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According to Jim Snyder (written commun. 1 October 2003): "The small Middle Brother event occurred at about 1210 hours on 22 July 2003. Visitors and Restoration employees alike saw a small rock fall from the top of the 22 February 2000, Middle Brother source. Chelsea Kashner on the Restoration crew saw dust almost to the top and pretty much along a straight line down the cliff. Abrasion marks were sparing on the bottom of the cliff. The top of the 22 February 2000 source is a kind of weathered granitic rock in a forest of mature live oak. The weathered rock does not look like the talus field one might expect on a high bench, the bench below the Mt. Broderick source for example. Instead, it looks like very weathered blocks in a kind of cement, as if it may have been left there long ago by glacial action. Regardless of its source, the live oaks have penetrated the conglomerate with their roots, producing many cracks of 1-2 inches. This area has been the source of rock fall off and on since 2000. Merrie Braun in a Camp 4 SAR site has recorded many small events from the Middle Brother cliffs since. Many of these have probably emanated from the top of the 22 February 2000 source. There was a short but torrential thunderstorm the afternoon of 18 July 2003. This small rock fall may have been a delayed response to that storm, but no trigger can be assigned to the failure. There have been small rock falls from the area since, but they have been smaller and break up, leaving much dust without reaching the road. The 22 July event did not reach the road either but the fact that it was observed midday by many

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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visitors made it an event of note. It is not possible to come up with a size of the failure because the conglomerate source does not lend itself to clear-cut, visible source scars. However, I would estimate that the failure was easily less than 50 tons. A photograph shows the source and fall line of the rock fall."

2003100401 Three Brothers Middle Brother RF Fall 10/4/2003 small

According to Jim Snyder (written commun. 4 October 2003): "This small rock fall brought rock onto the talus below Middle Brother near Northside Drive. Although a dust cloud was observed during the rock fall a definite source area could not be identified even with examination by helicopter and Questar telescope. The source likely took place in weak fractured material within the site of the 22 February 2000 source. Northside Drive was closed and was reopened after three days with no additional rock falls. Although the source could not be definitively examined, the volume of this rock fall was probably relatively small, perhaps less than 20 cubic meters."

2003120001 Merced River Gorge El Portal Road RS Fall 12/n/a/2003 small

According to Jim Snyder (written commun. 21 January 2004): "One large block - approximately 10 x 5 x 4 feet, about 7.5 cubic yards or 17.5 tons - hit the 70,000 volt transmission tower just northeast of Benchmark 2522 on the El Portal Road. The rock bent the tower, knocking its legs out but also lodging against the bent and broken legs. The transmission lines and the rock kept the tower precariously upright. The bent tower was first noticed 18 December by Trail Worker Barry Hance, Jr., on his way to El Portal. This block appears to have been loose, sitting on a steeply inclined slope of loose rock and soil, made up of material from a series of rock falls from the cliffs above. The block was below a protruding, bluff-like formation composed of weathered blocks from earlier rock fall. The source is at about 3000 ft. elevation or a little lower, roughly 300 feet above the tower and 450 feet above the El Portal Road. The rock took great leaps down the mountainside, leaving impacts every 100 feet or so and finally coming to rest against the smashed tower. Because its impacts were mostly in well-soiled areas covered with brush, live oaks, and grass, there was little secondary movement but also little breakage. It appears the rock reached the transmission line virtually alone. Periods of heavy rain in early December, along with freezing temperatures, suggest this rock slide was triggered by precipitation, but we cannot be certain." [Jose Lopez oral communications to Jim Snyder on 15 January and 20 January 2004 contributed information about this rock slide]

2003120002 Merced River Gorge El Portal Road RF/RS Fall 12/n/a/2003 medium

(1) According to Jim Snyder (written commun. 21 January 2004): "When PG&E workers checked the rock fall-damaged transmission tower northeast of Benchmark 2522 on 30 December, they noticed that one uphill leg had also been broken on the tower just southwest of the bent tower [ID 2003120001] and just north of Benchmark 2522, closest to the El Portal Road. One rock about 30 inches in diameter had done the damage and come to rest in the center area of the tower's four legs. This rock, however, was not alone. Instead it was part of a group of often weathered boulders and also freshly broken rock which had come down an older debris-flow path just a few yards west of the tower. The tower sits on a small bench formed by larger previous rock slides, and that bench restrained a portion of this failure. Other, larger rocks passed the tower and stopped in the talus within about 50 feet of the El Portal Road. Jose Lopez and Jim Snyder examined this rock slide area on 15 January 2004, but we were unable to see the source area from the ground. After a flight on 28 January 2004, we could see the source area and path clearly. We could see that the rock fall came down a traditional, intermittent drainage and that it had brought a quantity of weathered, partly rounded rock with it. We estimated the source to be about 50 feet high by 8 feet across and 8 feet deep, a kind of long triangular piece, wedged into the cliff and sitting upright on a steeply outslipping shelf, and loosened partly by the root systems of one or two

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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mature bull pines. The piece that fell consisted of about 59 cubic yards weighing about 140 tons. The block fell from about 3,400 feet elevation, breaking up on the cliff as it dropped. It then entered the intermittent drainage which had been subject to several debris flows which had cleared out the live oaks and shrubs in their paths. The upper part of the flow channel is ditched, while the lower part has the distinctive raised lobe of a debris flow that came to a stop on the slight bench near the transmission tower. Impacts in this debris flow channel liberated the more weathered, rounded rocks that joined the initial fall on the way down. The latest debris flow lobe, ending near the tower, seems composed of soil and roughly 1.5 feet of rocks for the most part. The lobe acted as a cushion for some rocks in this event but also may have deflected several rocks toward the tower, contributing to the damaged uphill leg. Major December storms occurred 5-7 December, 10-11 December, 13-15 December, 20-21 December, 24-26 December, and 29 December 2003 -3 January 2004. Because this rock fall occurred in a traditional drainage subject also to debris flows, the likelihood that the event was triggered by precipitation is great but cannot be stated for sure." [Jose Lopez oral communications to Jim Snyder on 15 January and 20 January 2004 contributed information about this rock slide]

2003120003 Merced River Gorge Cascades RS Winter 12-1/n/a/2003-2004 small

According to Jim Snyder (written commun. 21 January 2004): "Acting Trail Supervisor Jose Lopez first noticed this slide on 15 January 2004, after which he and Jim Snyder went to look at it. There was no clear attachment to the cliff, but the failed block had cleared a path through live oak and pines from the source at about 3,800 feet just west of Cascade Creek as it enters the small valley of Cascades and joins the Merced River along the El Portal Road. The block broke up as it slide and fell down several narrow benches into wooded talus, coming to rest above approximately 3500 feet. (The El Portal Road in the area is at about 3,440 feet.) The rock slide is clearly visible from the Cascades bridge. Robert Cameron, Above Yosemite (1983, p. 9) has an aerial photograph of the Cascades area showing this cliff. The block that failed is distinctive, appearing to be completely detached from the wall, a thick slab that simply laid over at some point before 1983 without going down the cliff. The source in Cameron's photograph is bright white and unweathered by comparison with many other sources on the cliff. This block appears to be very approximately 20 x 15 x 5 feet overall or about 56 cubic yards. This crude estimate suggests the block was >50 cubic yards in any case. Grass around the failure and newly broken vegetation shows the Cascades rock fall had no recent impact at the source but was indeed a detached block. It slid on soil, vegetation, and smaller rock before breaking up and crashing into the talus. The vegetation was quite green and fresh when we saw it. The situation of failure appears to have been one of ground saturation. Perhaps earlier storms and gradual erosion over the years had removed enough soil underpinnings to create a new instability. The trigger was probably one of the December-January storms when heavy rains and snow saturated the ground underneath the detached block enough that more rain could move it. Those storms before Jose Lopez's observation occurred 5-7 December, 10-11 December, 13-15 December, 20-21 December, 24-26 December, and 29 December 2003 - 3 January 2004. The last two were hardest and longest, with the greatest opportunities for significantly enhancing earlier saturation."

2003122001 Yosemite Falls Yosemite Falls Trail RF/RS Fall - Winter 12/20-23/2003 medium

(1) According to Jim Snyder (written commun., 21 January 2004): "Interpreter Jeffrey Trust was working in the Valley Visitor Center the morning of 24 December and wrote Jim Snyder and the Protection Rangers that "A visitor reported to the visitor center today that the Upper Yosemite Falls trail below Columbia Rock is completely covered by boulders and downed trees for a few dozen feet. The boulders are several feet wide; the trees are about a foot in diameter. The reporting visitor and another pair of visitors were able to continue on the trail by scrambling over the boulders and trees. I don't have any information about when this rock slide occurred, other than it occurred prior to this morning." Trust

also left a message with the Trails Office. (2) Yosemite National Park Case Incident Report 04-0067 notes that on 27 December 2003 at 09:00 ranger Todd Bruno "received a third hand report from Park Dispatch that rocks were blocking the Lower Yosemite Falls trail. It was undetermined when the rock fall occurred. At about 11:00 Park roads and trails foreman Tim Ludington surveyed the area from a helicopter which prompted a temporary trail closure while further assessments of the rock fall area could be made. On 8 January 2004 trail crew foreman Dave Kari and Johnny Ray hiked up to the slide area which is slightly west of Columbia Point. They discovered two large 'desk-sized' boulders in the trail and a leaning oak over the trail. Kari reported that dangerous conditions still exist as snow build-up (now hardened, but melting) is acting as a temporary stabilizer, preventing further slide debris from tumbling. Kari reports that as the snow melts, unstable rock debris might source. Kari and Ray removed the leaning oak." (3) According to Jim Snyder (written commun., 21 January 2004): "It is not possible to determine exactly when this rock fall occurred. Given the frequency of use of the Yosemite Falls Trail even in winter, however, we can narrow the time of occurrence with some certainty to 20-23 December. If it occurred before the December 20, a period of good weather, a report would have likely come in about it. A storm on 20-21 December 2003 probably prevented almost all trail use. The earthquake of 22 December 2003 may also have prevented use, so a report of damage on 24 December would be a fairly quick response given the weather and time of year. Jose Lopez and Jim Snyder examined the source from the trail, from the air, and with a Questar telescope. The source is at an elevation of about 5,300 feet. The failed slab was about 80 feet long, 15 feet wide, and 4-5 feet thick, or about 222 cubic yards, and 525 tons. At or near the top of the slab grew one large yellow pine, and maybe a second pine, which had extended its roots roughly a third of the way down behind the slab. Much of the plane behind the failed slab was weathered. When the slab failed, it threw the large yellow pine to a wooded ledge just west of the source. The slab slid from its source, fell a ways down the cliff, breaking up as it went, soon hitting the talus and live oak-pine forest. Much of the rock stopped there, cutting a wide swath through the forest, but some material made it to the Yosemite Falls Trail at about 4680 feet, about 50 yards east of the first stream crossing at the top of the lower 48 switchbacks of the trail. A few rocks went even further, one apparently damaging a corner of those lower switchbacks. Snow soon covered the debris. Some loose rock remained visible on ledges above the trail, so the trail was closed for further observation and eventual repair."

2003122201 Sentinel Rock Sentinel Creek DS Winter 12/22/2003 medium

(1) According to Yosemite National Park, Yosemite Emergency Command Center, Law Enforcement, "Detailed Report of Responses" (written commun., 14 January 2004): "Report of an active rock slide. Possibly aftershock from 6.5 earthquake earlier at approximately 11:15. Rock slide occurred at approximately 12:07 hours. Site being monitored." (2) According to Jim Snyder (written commun., 21 January 2004): "Media Relations Chief Scott Gediman was the reporting party for this event and explained to Jim Snyder on 21 January 2004 what he experienced. Gediman was walking out of the Administration Building when he heard a loud, rumbling sound from the direction of Sentinel Rock. He told Jim Snyder that it was quite loud and that he could hear the impacts of individual rocks clearly within it. He saw no dust and could not see the location. Scott went back into the building, but others had not heard it. He called Valley District Ranger Jim Tucker and Park Dispatch to report the event. No one saw or heard any other, later failures from that area. I [Snyder] looked for new sources in the Sentinel Rock and Sentinel Creek area, but found none from exposed cliff faces. This failure seems to have been a debris slide from an unconsolidated till or debris at about 6,000-6,200 feet elevation just west of Sentinel Creek. The volume of this debris slide cannot be easily estimated, but 200 cubic meters would be reasonable considering earlier failures in the same area [ID 1980052704 and 1983052001] and Gediman's description of the sound. Snow covers the source area, preventing a better estimate. This failure affected no facilities, but we did notice that the failure and others like it have contributed to a

channel change in the Sentinel Creek gorge below Sentinel Falls. There has been a huge bank failure there, sending many, many tons of material into the creek and down toward Southside Drive. Most of the larger material in the 1997 flood and later has stopped at the mouth of the small but impressive Sentinel Creek gorge, leaving only a very small barrier to prevent the creek from changing direction from its more recent historic crossing of Southside Drive east of the turnoff to Sentinel Beach to a more direct route flowing across a broad fan west of that turnoff and west of the picnic area. This rock fall was an indication of how Sentinel Creek has frequently altered its lower channel. This failure may well have had an earthquake trigger. Though there was 0.33 inches [0.84 cm] of rain on 20 December and 0.29 inches [0.74 cm] on 21 December, no rain fell on 22 December. The failure could have been triggered by precipitation saturation, however, in conjunction with an earthquake. In Yosemite Valley, there were reports of goods shaking on shelves in Degnans and the Village Store." (3) From U.S. Geological Survey, National Earthquake Information Center (2004): A M4.1 earthquake (aftershock of 11:15 a.m. earlier M6.5 earthquake) occurred at 12:06 p.m. at a distance of about 270 km from Yosemite Valley. [The M 4.1 earthquake aftershock was also approximately 270 km west of Yosemite Valley and unlikely to trigger a debris slide in Yosemite Valley according to relationships between earthquake magnitude, epicenter and furthest observed historic rock slides (Keefer, 1984)]

2003122601 Glacier Point Staircase Falls RF Winter 12/26/2003 medium

(1) According to Yosemite National Park, Yosemite Emergency Command Center, Law Enforcement, "Detailed Report of Responses" (written commun., 14 January 2004): At 00:50 "Several 911 reports of rock slides and people trapped, yelling for help." The notes show that several cabins were hit, and one three-year-old injured slightly. Evacuation and relocation [of visitors] began quickly. At 01:38 it was determined that "no one is trapped and situation is being assessed." Light snow falling, unable to put lights on cliff for monitoring. At 02:25 "66 units evacuated. 4 people treated for minor cuts and scratches." At 03:29, 33 more units were evacuated. As of 07:00 there had been no new rock fall activity. (2) According to Yosemite National Park Case Incident Record 03-4014 (written commun., 14 January 2004): "On 26 December 2003 at approximately 00:45, a large rock fall occurred in eastern Yosemite Valley - Curry Village. The Yosemite Communications Center received the call at approximately 00:48 and immediately Park Dispatched emergency personnel to the scene. Upon arrival, it was determined that four park visitors sustained minor injuries and 12 structures were damaged by rock fall debris, with some cabins having been fully penetrated by flyrock and small boulders up to 30 cm in diameter. Subsequently, 68 guest units were evacuated and a closure perimeter was established around the rock fall zone. Emergency personnel worked through the night and into the following day searching for injured visitors and assessing damage to park infrastructure. ..." (3) According to Jim Snyder (written commun., 8 January 2004): "This rock fall occurred at night [00:45] during a heavy snowstorm. A number of duplex cabins-with-bath were hit at the west end of Curry Village. About 100 people were evacuated to accommodations in El Portal. Twenty-one duplex cabins were closed first, but when day broke and it was easier to see large flyrock, thirteen more duplex cabins were included within the closure. A foot of snow on the ground made it impossible to determine the flyrock and talus patterns clearly at impact. Some small rock had clearly gone beyond the closure area. Damage to the cabins occurred in two ways. One kind of damage occurred when pieces of the rock fall hit large rocks in the Curry vicinity and exploded on impact, sending smaller pieces through the cabin sides and windows. These pieces tended to be smaller, though it was just by good fortune none of them were lethal. The second kind of damage came from rocks launched high in the air and coming through the roofs, eaves, and porches, sometimes through north-facing roof pitches. These rocks, generally the size of a sink or half a woodstove, seem to have been launched at a high velocity from the J2 joints forming the east-trending ledges of Staircase Falls. These ledges slope outward as well as downward and can easily throw higher velocity rock toward Curry Village's west end. The source is visible from the cabins. It is located

on the northeast side of a small fin separating LeConte Gully from the big ledge of the old Ledge Trail and Staircase Falls at about 5800 feet elevation. The source extends to the top of this fin, so there is nothing unstable above it. The source is about 2000 feet southwest of the west end of Curry Village. It was the J2 east-trending joints that funneled the rock fall so far east to the Curry duplexes. Ordinarily these joints protect Curry because they funnel most rock fall down the big ledge into the talus behind the Nob Hill Showerhouse. [Guzzetti et al. (2003) show a model of the topographic effects of the ledge on rock fall from above Staircase Falls] Even in this rock fall, part of the material remained on that big ledge. But the source was far enough west, with enough of an initial drop that a large portion of the material took the path of Staircase Falls. SAR photo #5456, taken in the 1970's, shows a partly overgrown track through the live oaks from the source to the top of the Staircase Falls. Since the duplexes were built 1918-1922, this track suggests that rock fall from the same location occurred about 100 years ago. Smaller rock fall from the source may have fallen in the interim, however, without reaching Curry Village or being reported. The first thing Chief Ranger Steve Shackelton noted about the source was its unusual color, not steel gray but fawn or rusty. That was a sign of weathering at the source area. SAR photo #5456 and Dan Horner's spring 2001 photograph of the cliff clearly show a long weathered roof with a small tree growing at its top. Examination with the Questar suggested that there had been three layers of this roof stacked one on top of the other, with roots and seepage going behind and through them. West of the roof were two other thinner plates which were apparently launched as the roof failed. Several estimates have suggested a jumble of irregularly shaped blocks about 20 feet high and 60 feet across with thicknesses up to 6 feet. Tapering of the formation at the top and a thinner plate on the west side indicate that 267 cubic yards or 630 tons might be close to a maximum accounting for what actually fell. All the blocks and plates but one were weathered, with very few signs of fresh breakage along unweathered surfaces. The one block that showed an entirely unweathered break was a small plate roughly 3.5 feet thick underneath the others. Seepage had been pouring through the weathered roof at the time of the failure, for after the storm there was a small ice waterfall present next to the unweathered break. These observations suggest that the greater weight on top of a thinner though less weathered plate contributed to the initial failure of that plate during the storm. The plate was a keyblock supporting the rest, so the two layers above it fell and dragged the two weathered western plates with them. The remaining source is composed of weathered blocks often separated by wide, weathered joints along several different joint planes. The source sits at the top of a fin between LeConte Gully and Staircase Falls. J2 joints, among others, pass from the source formation into LeConte Gully. Seepage and flows from that gully along J2 and other joints contributed to the weathering of the formation over the last million years, since the source is above the maximum level of the Tioga glaciation. Flows from LeConte Gully through the formation have left a markedly dark stain on the cliff and have been the source of a small, intermittent drainage which makes its way to the cliff at the head of Staircase Falls. The weathering of this fin is more substantial than on the massive face of Glacier Point because the fin is much thinner and exposed on two sides as well as being subject to the heavier joint seepage from LeConte Gully. Much of the failed rock came down Staircase Falls, but a large percentage remained on the big ledge. Later rock fall, such as ID #2003122603, came not from the source but from debris remaining on the big ledge. Drainage through the source from LeConte Gully was slowly washing through the debris and snow, with muddy issue from the snow appearing between storms. Smaller rocks have been moving with the storms toward the cliff's edge. The duplexes will probably remain closed until unstable material is washed away, leaving more stable material behind. This rock fall also happened in the midst of a storm. A check of the weather records for Yosemite Valley - station YSV in the California Data Exchange Center website- shows that 0.52 inches [1.3 cm] of precipitation fell on 24 December, 0.84 inches [2.1 cm] on 25 December and 2.76 inches [7.0 cm] on 26 December 2003. There was some freezing with this because snow was falling heavily on the valley floor." (4) According to Jim Snyder (written commun., 28 December 2003): "Some smaller rocks

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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(football size?) went horizontally through a cabin or two. One of these broke through a window, went right over the head of a sleeping person, and crashed into a mirror in the bathroom. Another pingpong ball size rock went through a window in the residence behind the Nob Hill showerhouse - this seems to be the farthest east impact, and nobody could quite figure out where that rock came from. Behind cabin 80 there were a number (20-30) of trees 12-14 inch diameter snapped off by rock. Some rocks came down vertically into the cabins, crashing through the roof and between beds with sleeping people. Four people were treated for minor scrapes and scratches. Nobody had to go to the hospital. Evacuees were taken to Parkline just outside the park on Highway 140 for the night. Monitors listened for rock fall for about 12 hours and heard nothing more. There were no rock falls from the 1998-99 Curry source during this storm. (5) From the Fresno Bee (27 December 2003): "Rock fall injures 4, damages buildings: Four people were treated for minor injuries after the rocks fell shortly before 1 a.m., apparently from a ridge above the west end of Curry Village. Six buildings were damaged. National Park Service rangers relocated an estimated 100 visitors from 33 duplex units in Curry Village as a safety precaution until the source area of the rocks can be evaluated... [Ranger Deb Schweizer] described the injuries from falling rocks as 'not bad' - cuts and scrapes. Damage to the buildings was mostly broken windows and cracked roofs." (6) From Wieczorek et al. (2008): "Approximately 200 m³ of rock detached from an area about 110 m² on the northeast side of the bedrock fins. The rock mass free fell approximately 20 m onto bedrock joint surfaces, and continued northeast approximately 370 m horizontally and 480 m vertically to the base of Staircase Falls. Numerous boulders as large as 11 m³ fell to the lower limit of the talus slope at the base of Staircase Falls. Several flyrock fragments extended as much as 75 m beyond the base of the talus. Observation of the detachment area in April 2004 revealed an estimated volume of 350 m³ of potentially unstable rock remained in the form of a fractured, jointed, and moderately weathered bedrock fin. Some rock debris remained perched on the ledges below the detachment area, and the cumulative volume of debris now present is approximately 840 m³, presenting an additional hazard."

2003122602 Yosemite Falls Yosemite Falls Trail RF Winter 12/26/2003 medium

According to Jim Snyder (written commun. January 21, 2004): "When I [Snyder] went to examine the Yosemite Falls Trail source west of Columbia Point, I discovered another source far above the stream and gully at the top of the first 48 switchbacks of the falls trail. The source appeared as a rectangle of clean, fresh granite on a lichen covered wall next to an intermittent drainage. The rather thin rectangular flake hung nearly vertically about 40 feet east of an intermittent drainage often frozen in winter at an elevation of about 6,500 feet. The flake was approximately 20 x 15 x 4 feet or about 44 cubic yards (105 tons). Though the source appeared clean, there was dirt and mud on the outslipping ledge beneath it, suggesting there had been some soil and vegetation there which was dislodged by the source. The flake failed, probably broke up some, slid over a short outslipping ledge, then had a 1,500 foot freefall into a talus-loaded, loose, saturated, steep gully beginning at about 5,000 feet. Impacts from the flake fragments dislodged rocks in this gully. A few small rocks landed on the trail at 4,680 feet. One larger one may have contributed to damage on the corner of a lower switchback in the talus below. This day brought 2.76 inches [7.01 cm] of rain and snow to Yosemite Valley, preceded by 0.52 inches [1.32 cm] on 24 December and 0.84 inches [2.13 cm] on 25 December 2003. The nearby drainage was flowing, with some ice. The heavy storm prevented people in the Valley below from hearing this noisy rock fall."

2003122603 Yosemite Falls Yosemite Falls Trail RF/RS Winter 12/26/2003 medium

According to Jim Snyder (written commun. 14 January 2004): "A rock fall occurred above the Yosemite Falls Trail above Columbia Point. The source was at an approximate elevation of 5,500 feet, east of Columbia Point above the first drainage. The trail was hit, but apparently not by very much. Volume

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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approximately 20 cubic meters. The rock fall was from a very weathered, vegetation fractured source. This source was the same as [ID 1973060001 and 1977000003]."

2003123001 Merced River Gorge Big Oak Flat Road RS Winter 12/30/2003 small

According to The Yosemite National Park Emergency Command Center, Law Enforcement, Detailed Report of Responses" to rock fall in the 911 system notes (written commun., 14 January 2004): At 20:17, a "rock slide [on the Big Oak Flat Road] just below long tunnel, blocking the west-bound lane. Some rocks 6 feet in diameter." The road was closed and did not reopen until 31 December at 08:58. Again there had been a storm during which this rock slide occurred. The California Data Exchange Center shows the following precipitation: 0.14 inches [0.36 cm] on 29 December; 1.20 inches [3.05 cm] on 30 December; 0.03 inches [0.08 cm] on 31 December 2003. Damage occurred to the road, but there were no injuries. The rock slide occurred at an elevation of about 4,500 feet.

2004010101 Yosemite Falls Lower Yosemite Falls RF Winter 1/1/2004 small

According to The Yosemite National Park Emergency Command Center, Law Enforcement, Detailed Report of Responses" to rock fall in the 911 system (written commun., 1/14/04): "[Report of a rock] slide above lower [National Park Service Lost Arrow] housing. Bridge is intact at Lower Falls with some debris hung up on it." [No source could be found for this report, though it could easily have been rocks and perhaps some trees washed over the fall and dislodging other material downstream by the Lower Yosemite Falls footbridge]

2004010601 Giant Staircase Vernal Fall RS Winter 1/6/2004 medium

(1) According to Yosemite National Park Case Incident Report 04-0055 (written commun., 14 January 2004): Ranger Todd Bruno reported: "On 6 January 2004 at about 14:30 I [Bruno] received a report via Park Dispatch that visitors reported rocks across the John Muir Trail below the Vernal Falls footbridge. Trail crew foreman Jose Lopez responded to the area and reported 400 to 600 tons of rock had fallen about 1/8 mi. up the John Muir Trail from the Happy Isles trailhead. Lopez further reported that about 50 feet of trail had been covered and damaged by the rock fall. Lopez confirmed no one appeared to be injured. It is unknown when the actual rock fall occurred. I enacted a temporary trail closure at the Happy Isles trailhead and search and rescue technician Gab Flaxman hiked up to the Vernal Falls footbridge where he set up barricades and signs, closing the upper section above the rock fall. The area remains closed with barricades, tape and signs while further investigation of rock fall danger, trail assessments and repair are complete." (2) According to Jim Snyder (written commun. 4 February 2004): "This rock fall occurred about 75 yards above the spring on the John Muir Trail southeast about 900 feet from the Happy Isles Nature Center. The source is about 75 feet in elevation above the trail at an elevation of about 4,200 feet. The source is about 50 feet wide and 30 feet high but with a varying thickness. The slide was initiated when several large blocks broke out of a pocket at the bottom of the source. This pocket of larger material was about 38 feet long, 12 feet high, and 6 feet deep at the top; however, the rocks in it were thinnest at the bottom, clumsy triangles resting on a thin, outsloping lip on a joint plane dipping 42 degrees to the northwest. Since the rocks fell just across the trail with little breakage, a possible progression of the slide could be determined. A block at the northeast end of the pocket seems to have failed first, followed by three other large blocks just southwest. The overburden was quite weathered, fractured, and finely penetrated by live oak roots. Removal of the bottom blocks brought failure of the top and some rock along the sides, probably up to 30 inches thick. A rough estimate of the total volume is 165 cubic yards or 388 tons. The rock slide swept away much of a small band of talus and trees bordering the trail. The source was weathered with many roots. There had been few fresh rock connections. Though there were streams of seepage on both sides of the source, some of them developing ice cascades during the storms of the period, there was no evident seepage in

any quantity in the source itself. The soil of the roots, however, was damp, and the vegetation growing on the failed blocks showed this location to be a moist one. Such a well-weathered source so far beneath (approximately 1,200 feet) the line of maximum extent of the Tioga glaciation is unusual, especially in this area where the ice was thickest. There had been no precipitation since 3 January, but there was still a lot of snow on the ground, with snowmelt during the day and freezing temperatures at night. It is not possible to determine a trigger. This source may have destabilized more material on its southwest end, for several older cracks showed signs of widening after the failure. It was too wet and slippery to get on top of the source to see if there had been any crack widening there. The source was otherwise clean and seemed no immediate threat to the trail or passing visitors. Trail crews put a way trail through by 29 January, intending to wait until spring before fully repairing the trail. The trail was posted at the rock fall area with a rock fall warning and description."

2004010602 Wawona Road Grapevine RS Winter 1/6/2004 small

According to The Yosemite National Park Emergency Command Center, Law Enforcement, Detailed Report of Responses to rock fall in the 911 system (written commun., 1/14/04): "The rock fall occurred at 'Grapevine,' an intermittent drainage crossing the Wawona Road about 3/4 mile north of the entrance to the Wawona Campground or 1.5 miles north of the Wawona gas station. There are two short rock guard walls along the southbound lane at 'Grapevine'." [The road was cleared by 12:52 am. Wawona Road Foreman Steve Ybarra told Jim Snyder the crew removed about 10 cubic yards of material from the road.]

2004010701 Wawona Road Wawona Road RF Winter 1/7/2004 very small

(1) According to The Yosemite National Park Emergency Command Center, Law Enforcement, Detailed Report of Responses to rock fall in the 911 system (written commun., 14 January 2004): "At 4:52 pm a rock was blocking one lane of the Wawona Road, 2 miles south of Wawona Tunnel. At 5:44 pm the road was cleared." (2) According to Jim Snyder (written commun.): "The rock fall occurred from the cliffs above the steep roadcut below BM4968. California Data Exchange Center shows 0.18 inches of precipitation this day. There was impact to the Wawona Road but no injuries."

2004010702 Glacier Point Staircase Falls DF Winter 1/7/2004 very small

(1) According to The Yosemite National Park Emergency Command Center, Law Enforcement, "Detailed Report of Responses" to rock fall in the 911 system (written commun., 14 January 2004): At 18:42 a "report of large rock fall some-where in Curry Village" was recorded. A further message at 18:47 stated: "Possibly came from the LeConte [Gully] area. Units in area cannot locate anything at this time." At 18:50 "V33 heard additional rock fall still searching for location." At 18:56, "rocks are falling in the same area that is roped off and unoccupied." On 8 January at 09:00, the message came that "most icicles on Staircase Falls probably fell overnight., There is fresh run from them. There is also recent avalanche at the bottom of LeConte Gully." They were going to keep a running log of this incident, but no more activity occurred. (2) According to Jim Snyder (written commun.): "Chief Ranger Steve Shackelton had noted mud on Staircase Falls earlier. Ranger Steve Yu's photograph of the ledge immediately below the Staircase Falls source showed muddy stream flowing through the new debris and snow. With some warming of temperatures and the precipitation of early January and 0.18 inches [0.46 cm] of rain on this day, it is not surprising there was some continued activity. Examination of the source and photographs of the source taken 27 December 2004, however, suggest that this reported rock fall and avalanche activity came not from the source but from the unstable deposit beneath it. There is still too much snow on the ground to tell much more about what happened on 16 December and after. However, for this 7 January 2004 event, I [Snyder] think we can say there had been some movement of both rock and snow.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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There appears to have been no new damage at Curry Village and no injuries from the events reported this day."

2004010801 Merced River Gorge Big Oak Flat Road/Rattlesnake DS Winter 1/8/2004 small
 (1) According to The Yosemite National Park Emergency Command Center, Law Enforcement, "Detailed Report of Responses" to rock fall in the 911 system (written commun., 14 January 2004): At 18:37 a report came of a rock slide on Highway 120 approximately one mile south of Crane Flat store blocking both lanes. At 6:55 pm, a call noted "some debris on road with some large rocks which might need more than a blade plow." At 7:09 pm, a call noted the "slide occurred at Rattlesnake and source area is visible approx. 15-20 feet above roadway." The road was closed at Crane Flat and at the Foresta junction, while Valley Roads Foreman Ed Appling brought a loader up from the valley. At 22:37, the Big Oak Flat road was reopened. (2) According to Jim Snyder (written commun., 14 January 2004): "The description of location does not quite match up, since Rattlesnake is actually 3.6 miles below the Crane Flat gas station. In any case, there have been numerous slumps and slides in the roadcuts and slopes just above them in this area of the road, which is at about 5,400 feet and nearly two miles above the long tunnel and the much deeper roadcuts into bedrock of the lower Big Oak Flat Road. The road was impacted but there were no injuries."

2004011001 Glacier Point LeConte Gully RF Winter 1/10/2004 small
 According to Jim Snyder (written commun., 27 January 2011): "Several reports of a rock fall from the LeConte Gully area on the west side of Glacier Point that occurred at night around 11 pm PST. The reporting party was a Valley LEO Ranger living in the valley and attuned to rock fall. It was not observed due to darkness but was clearly heard. However, it was still small enough that a new source area could not be identified the following day. No injuries or infrastructure impacts occurred. A trigger for this event was not recognized."

2004011301 Glacier Point Staircase Falls RS/RF Winter 1/13/2004 very small
 (1) According to Valley Law Enforcement Ranger Todd Bruno (written commun., 13 January 2004): A rock fall in the vicinity of the Ledge Trail/Staircase Falls. Dan Marino reported hearing "the whoosh of a large rock fall about 1.5 seconds, then heard it hit, bust up, and continue falling." (2) According to Jim Snyder (written commun., 27 January 2011): "The event started as a rock slide but as debris slid over the lip of Staircase Falls it became a rock fall, and that is what the reporting party heard. The rock came from debris left at the top of Staircase Falls following the 26 December 2003 rock fall. There were no human or infrastructure impacts in Curry Village."

2004022501 Glacier Point Staircase Falls RF Winter 2/25/2004 small
 According to Valley Law Enforcement Ranger Todd Bruno (written commun., 25 February 2004): A rock fall occurred in the vicinity of the Ledge Trail/Staircase Falls. Although ice was present, Bruno determined that the failure was more likely rock than ice. According to the reporting party, the rock fall lasted 15-20 seconds followed by a smaller secondary event of 3-5 seconds. No new flyrock was visible in Curry Village, and there was no apparent damage to facilities.

2004022901 Hetch Hetchy Wapama Falls RF Winter 2/29/2004 small
 According to Jim Snyder (written commun., 27 January 2011): "Although there was no clear location for this rock fall provided, it was suggested to be on the east side of Wapama Falls on the several switchbacks heading east from the bridges over Falls Creek. Those switchbacks have been hit a number of times by rock falls from the cliffs above."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2004030001 Merced River Gorge Elephant Rock RF Winter 3/n/a/2004 small

According to rock climber Melissa Michelitsch (written commun., Supertopo.com Forum): A rock fall occurred from the east side of Elephant Rock, near the climbing route "Trundling Juan".

2004030801 Three Brothers Middle Brother RF Winter 3/8/2004 small

According to Jim Snyder (written commun., 27 January 2011): "A small rock fall occurred on 8 March 2004 from Middle Brother. The rock fall was observed by Yosemite Institute instructor Brian Torrey, who first heard the rumbling and then turned to see it. He did not see the exact source area on the west side of Middle Brother but did see the rock-fall path onto and across Michaels Ledge and down to the talus at Rocky Point. Some of the fresh rock debris remained on Michaels Ledge. Torrey thought the cumulative rock fall volume was about the size of a car [roughly 10 m³], composed of several smaller blocks 2-3 feet [0.75- 1 m] across. The rock fall appears to have originated from the vicinity of the 10 March 1987 source area, but a specific source area within that scar could not be identified. A likely trigger could not be determined."

2004032601 Merced River Gorge Big Oak Flat Road / Rattlesnake RF Spring 3/26/2004 small

Report from Park Dispatch of a rock fall on Big Oak Flat Road, at or near the corner at Rattlesnake. Rock debris, consisting mainly of a boulder "half the size of a VW bug" (approximately 5 m³) was reported as blocking both lanes of the road.

2004051201 Basket Dome Basket Dome RF Spring 5/12/2004 small

According to Jim Snyder (written commun., 27 January 2011): "This small rock fall occurred from the bottom edge of the source area of the much larger winter 1996 Basket Dome rock fall above Mirror Lake [ID 1996010001]."

2004051501 Cathedral Rocks Middle Cathedral Rock RF Spring 5/15/2004 small

(1) According to Valley Law Enforcement Ranger Todd Bruno (written commun., 15 May 2004): A rock fall from the northeast face of Middle Cathedral Rock, in the vicinity of the climbing route "Central Pillar of Frenzy". Park Dispatch reported that climbers were seen in the area. Bruno headed toward the base of Middle Cathedral on the Valley Loop trail and encountered park visitor James Maxwell, who had sustained lacerations to his face, forehead, and arms. Maxwell later stated that he was engaged in conversation with climber Paul Larson at the base of the "Central Pillar of Frenzy" route when Larson shouted "Rocks! Run!". Maxwell heard a rumble overhead and ran away from the base as rocks hit the ground around him; after running about 30 to 40 feet, he turned back toward the cliff face and was struck in the head by a rock, knocking him unconscious. He awoke face down after the rock fall had stopped. Aside from the rock that caused his forehead laceration, he surmised that his other injuries had occurred by falling to the ground. Climber Larson also incurred leg injuries by falling while attempting to run away from the base of Middle Cathedral. A climbing party on the "Central Pillar of Frenzy" rappelled off unassisted and reported no injuries. Bruno noted fresh flyrock extending from the "Sacherer-Fredericks" climbing route to the base of the "Direct North Buttress" climbing route, a distance of about 600 horizontal feet. (2) According to Jim Snyder (written commun., January 2011): "Although many visitors in El Capitan Meadow witnessed the rock fall from Middle Brother, it was initially difficult to locate the actual source area. Using a spotting scope from Woski Pond area, I located the source area high on Middle Cathedral Rock, above the "Kat Walk", in a jumble of weathered, cracked blocks obscured by live oaks and brush. There were no scrape marks, disrupted vegetation, or freshly loosened rock anywhere above or to the side of the actual source area. At least one larger block and several smaller blocks and slabs fell from the base of a partial arch formation broken at the top by a cross-cutting joint forming a ledge with live oak brush. It looked like a pile of partly free, mostly

weathered rock with vegetation in it that collapsed and mobilized other debris, especially in the gully below. The volume was very difficult to estimate, hence the general estimate of 20 m³. There was a live oak tree trunk within the source area. The dark color in back of it may have been moist soil from the rootball. The tree trunk was on several thin slabs cracked into blocks, which may have toppled the rock formation forward. There were no other hints of a trigger beyond possibility that it may have been wind in the trees and brush, along with roots pushing out through weak, weathered, and fractured rock, that finally brought these blocks down."

2004052901 Glacier Point Happy Isles RF Spring 5/29/2004 small

From Jim Snyder (written commun., 27 January 2011): "A rock fall from the Glacier Point area was reported by Valley District ranger Leslie Reynolds, who heard 5-10 seconds of rock fall sounds while on the Nevada Falls Trail. She observed rock impacts on the cliff below the 1996 Happy Isles rock fall scar and suggested that location as a likely source area. SAR technician Gabe Flaxman reported seeing a puff of dust near the top of the cliff, and others reported two or three large rocks coming out of the 1996 Happy Isles scar. Observation with a spotting scope failed to determine an exact source area with certainty. However, trajectories of the rocks making the impacts suggest that the source area was toward the south end of the 1996 Happy Isles rock-fall scar, probably from the very weathered and often wet portion of the Block C source area of the 1996 failure. It was not easy to differentiate new impact marks from those relating to the 1996 rock fall, but Reynolds' first-hand observation eliminated most of the uncertainty. There was no damage nor injuries. Because we could not locate a source area with certainty, we were also uncertain about a trigger for the failure; however, there was 0.69 inches [1.75 cm] of rain on 28 May and 0.34 inches [0.86 cm] of rain on 29 May 2004, suggesting precipitation as a possible trigger."

2004071301 Glacier Point Happy Isles RF Summer 7/13/2004 medium

From Jim Snyder (written comm., 20 July 2004): "At about 12:45 pm [PST], 13 July 2004, a rock fall occurred from the cliffs [below Glacier Point and] above Happy Isles. The failure was located at about 5,600 feet elevation, about three quarters of the way up the cliff to the Tioga glacial maximum and below the north end of the 1996 Happy Isles rock fall source area. The long flake [that failed] had been hit hard once, and perhaps twice, in 1996. The white scar just left of the new source is from 1996, when the end of the flake was broken off by impacts above. The source appears to be about 75 feet long, 25 feet high, and about 8 feet thick. The failure was in the neighborhood of 556 cubic yards, or 1,313 tons. A bright little girl of about 6 years old clearly saw the rock fall and told me emphatically that she saw small rocks fall first, then the big slab came down. The source was very dirty with material perhaps washed in behind it both before and after [the rock falls of] 1996. Earlier photos show no vegetation around the source, which is over 200 feet below the Tioga maximum. The Tioga maximum is marked by the edge of the long, inclined plane below the 1996 source, the plan or ramp which launched the big blocks in that event to create airblasts on the Valley floor. The failed block appears to have been broken along well weathered cracks at its top and along its north edge. The only visible cracks were at the bottom, suggesting that the slab fragment was held in place by a relatively thin connection at the bottom. This piece appears to have had two or three thin J1 joints through it, parallel to the face. My guess is that, with pressure of the weathered slab above, following the 1996 impacts, this bottom connection began to break first on 13 July, producing the smaller rock the little girl saw and removing the last support from the larger part of the slab above. The slope below the source is about 80 degrees... Scrape marks are abundant to show how it fell straight down a ways and then free fell to the talus below, where it was largely pulverized on impact. Vegetation that had grown back on the new talus slope formed in the 1996 event was removed in a small area. The dust cloud was said to have risen a thousand feet or more, according to Sara Franklin, who was giving a tour on a Valley tram at the time.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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The manager of the Happy Isles Nature Center felt the impact of the rock fall and saw the dust... There is no clear trigger for the event. The source is dry and the area around it is dry. There have been thunderstorms above the Valley, but they produced no measureable rain in the Valley. Previous measureable rain occurred on 28 May (0.69 inches [1.75 cm]) and 29 May 2004 (0.34 inches [0.86 cm]), according to the California Data Exchange Center. There were no injuries and no facility damage. No closures were implemented."

2004081301 Royal Arches Royal Arches RF Summer 8/13/2004 small

(1) According to Valley Law Enforcement Ranger Carly Lober (written commun., 13 August 2004): A rock fall occurred from the Royal Arches area, east of the "Royal Arches" climbing route. Lober was on the Valley bike path across from the Backpacker's Campground when she heard loud rock fall sounds lasting approximately three minutes and substantial dust in the air. Rock debris apparently stopped on the talus slope at the base of Royal Arches. Lober walked the Valley loop trail in the area and did not see any rock debris on the trail. (2) Photographs of the Royal Arches area taken by Jim Snyder indicate that the rock fall originated from near the top of the cliff, just east of the prominent, deeply-recessed arch just below the rim, near the start of the last pitch of the climbing route "The Cobra". The source area was a gray-brown, vertically oriented slot; based on this, the failed slab appeared to be about 2 m wide, 5 m high, and roughly 1 m thick.

2004081901 Glacier Point LeConte Gully RF Summer 8/19/2004 extremely small

From Jim Snyder (written commun., 27 January 2011): "I [Snyder] was measuring joints and Staircase Creek discharge in upper LeConte Gully, in the wide part of the gully upstream of Staircase Falls, when a rock fell from high up on one of the probably J2 joint ledges on the east facing wall of the Gully. I could not see whether the rock had just broken free of the cliff face or had slid off a ledge. I was unable to ascertain a trigger, although a M5.4 earthquake on the east side [of the Sierra Nevada] had occurred the previous day [18 August 2004] at 4:43 pm. There were no injuries."

2004083001 Sentinel Rock Sentinel Creek DS Summer 8/30/2004 medium

From Jim Snyder (written commun., 27 January 2011): "Seasonal National Park Service interpreter Brian Torrey observed a debris slide about 3:45 pm off of the cliffs above and west of Sentinel Creek, where previous debris slides have occurred in the weathered bedrock and/or glacial till on the ridges west of the creek. The slide did not consist of a great amount of material, but it raised a substantial dust cloud that took several minutes to dissipate. The previous failure at this location was ID 2003122201, which possibly had an earthquake and/or precipitation trigger; however, a trigger for this event was not recognized. There was no associated damage and no injuries reported."

2004090901 Glacier Point LeConte Gully / Staircase Falls RF Summer 9/9/2004 small

According to Valley Law Enforcement Ranger Todd Bruno (written commun., 9 September 2004): A rock fall occurred from the Upper LeConte Gully area of Glacier Point, perhaps at or near the 26 December 2003 Staircase Falls rock fall source area. A small dust cloud was associated with this event. No rock debris or flyrock extended beyond the talus slope.

2004101201 Union Point Chapel Wall RF Fall 10/12/2004 small

According to Valley Law Enforcement Ranger Mike Foster (written commun., 12 October 2004): A rock fall occurred from the Chapel Wall south of the Chapel. The rock fall was heard in Yosemite Village, and eyewitnesses observed a dust cloud behind the Chapel. National Park Service Fire personnel hiked the Valley Loop trail behind (south of) the Chapel and did not find any fresh rock on the trail.

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2004101601 Union Point Union Point RF Fall 10/16/2004 small

From Jim Snyder (written commun., 27 January 2011): "Valley District Ranger Jim Tucker observed a rock fall from the cliff behind the Chapel from a window in the Law Enforcement Office in Yosemite Village. The rock fall generated a big dust cloud but did not extend far enough from the talus slope to impact roads or buildings in the area. Neither an exact source area nor a trigger could be ascertained."

2004101901 Glacier Point Curry Village RS Fall 10/19/2004 very small

From Jim Snyder (written commun., 27 January 2011): "National Park Service Interpreter Ben Cunningham-Summerfield heard rock fall for 'a minute' from the Curry Village [1998-1999] source area. There were no visible changes to the source area, but since the first storm of fall had begun on 17 October, the material Cunningham-Summerfield heard was most likely from debris falling from the big ledge directly below the Curry Village source area. Precipitation was 0.17 inches [0.43 cm] on 17 October, 1.36 inches [3.45 cm] on 18 October, and 0.52 inches [1.32 cm] on 19 October, and 2.63 inches [6.68 cm] on 20 October 2004. Precipitation was the most probable trigger, as the loose debris on the big ledge was lubricated by runoff directly down the face of the Glacier Point cliff."

2004102001 Merced River Gorge El Portal Road / Dog Rock DF Fall 10/20/2004 small

From Jim Snyder (written commun., 27 January 2011): "A debris flow occurred below Dog Rock and just below Little Windy Point, originating from the bedrock of Parkline Slab on the north side of the Merced River Gorge. The debris flow left mud and rock on the El Portal Road from Little Windy Point to the park boundary. The flow was triggered by precipitation associated with the first major fall storm of the year: 0.17 inches [0.43 cm] on 17 October, 1.36 inches [3.45 cm] on 18 October, and 0.52 inches [1.32 cm] on 19 October, and 2.63 inches [6.68 cm] on 20 October 2004."

2004102002 Three Brothers Middle Brother RF Fall 10/20/2004 large

From Jim Snyder (written commun., 27 January 2011): "A small rock fall occurred from East Middle Brother, which is not properly Middle Brother but is that cliff above the climbing route "The Folly", between Rocky Point and the old Indian Village. The source area was midway up the cliff, from the upper part of the larger rock fall scar produced by the 22 February 2000 rock fall (see IDs 2000022201, 2000022202). The rock fall consisted of approximately 2,000 m³ of material, which appears to have been highly fractured and weathered; the freshly exposed detachment surface revealed brown and tan bedrock, suggesting substantial weathering. The rock fall was likely triggered by precipitation associated with the first major fall storm of the year; precipitation amounts were 0.17 inches [0.43 cm] on 17 October, 1.36 inches [3.45 cm] on 18 October, and 0.52 inches [1.32 cm] on 19 October, and 2.63 inches [6.68 cm] on 20 October 2004. Subsequent observation on 28 October 2004 showed seepage at the source area."

2004102003 Merced River Gorge Big Oak Flat Road RS Fall 10/20/2004 small

From Jim Snyder (written commun., 27 January 2011): "There was rock fall from the road cut at the second [middle] tunnel on the Big Oak Flat Road where National Park Service Roads had been working to resolve rock fall issues and where Hi Tech Rock was hired to scale and bolt the road cut above the Big Oak Flat Road. The fall was likely triggered by precipitation associated with the first major fall storm of the year: 0.17 inches [0.43 cm] on 17 October, 1.36 inches [3.45 cm] on 18 October, and 0.52 inches [1.32 cm] on 19 October, and 2.63 inches [6.68 cm] on 20 October 2004."

2004102101 Glacier Point Curry Village RS Fall 10/21/2004 very small

From Jim Snyder (written commun., 27 January 2011): "This rock slide initiated from the big debris-covered ledge below the Curry Village rock-fall source area, and occurred at around noon [11:01 PST] on

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the last day of a five-day fall storm. The Curry Village rock-fall source area was less than 60% dry [more than 40% wet] at the time of failure. There was no visible change in the source, but there was a lot of visible movement of rock debris resting on the big ledge directly below the source area. Some of that rain-generated movement contributed to this rock slide down onto the talus below."

2004102901 Glacier Point LeConte Gully RF Fall 10/29/2004 small

According to Valley Law Enforcement Ranger B. Hergert (written commun., 29 October 2004): National Park Service Interpretive Ranger Ben Cunningham-Summerfield reported a combination rock/snow/ice slide on the west side of upper LeConte Gully. The slide was audible for 10-15 seconds and produced a small dust cloud. It originated from the large northeast facing steep wall approximately halfway up the upper section of the gully, but an exact source area could not be determined. No rock or snow/ice debris made it down to Curry Village or the LeConte Memorial Lodge area.

2005000001 Half Dome Half Dome RF Winter - Spring n/a/n/a/2005 medium

According to Park Geologist Greg Stock: A rock fall occurred from relatively low on the northwest face of Half Dome, below and left of the failure area of the 2003 rock falls. Failure consisted of a thin (~1 m thick) slab about 10 x 4 m. This rock fall was not reported at the time it occurred, but was noticed during repeat photo comparison after the 1 July 2005 rock fall.

2005010401 Merced River Gorge El Portal Road / Windy Point RS Winter 1/4/2005 small

Report from Park Dispatch of a rock slide on the north side of the Merced River Gorge upstream of Windy Point, which sent rock debris onto El Portal Road. The road was closed for 1.5 hours while the slope was assessed for stability and the debris cleared. The volume was approximately 20 m³, and precipitation was considered to be the most likely trigger.

2005010701 Merced River Gorge El Portal / Foresta Road RS Winter 1/7/2005 small

Report from Park Dispatch of two rock slides onto Foresta Road in El Portal, between Rancheria Housing and Odger's Maintenance area. This area of road also lost a 20 foot section due to washout; the road was closed for several days for repairs.

2005010801 Merced River Gorge Big Oak Flat Road RF Winter 1/8/2005 very small

Report from Park Dispatch of a single boulder on Big Oak Flat Road near the westernmost (long) tunnel.

2005010802 Merced River Gorge El Portal Road / Parkline RF Winter 1/8/2005 very small

Report from Park Dispatch of rocks on El Portal Road 200 m up the road from Parkline [the western boundary of the park].

2005010901 Merced River Gorge El Portal Road RF Winter 1/9/2005 very small

Report from Park Dispatch of "4-5 large rocks" on El Portal Road near the Powerhouse.

2005010902 Glacier Point Curry Village RF Winter 1/9/2005 small

Report of rock fall sounds from the Glacier Point area above Curry Village. Darkness prohibited locating the exact source area, but no fresh rock debris was located within the developed areas of Curry Village.

2005011001 Indian Canyon Castle Cliffs RF Winter 1/10/2005 small

Report from Park Dispatch of a rock fall from the Castle Cliffs area above the National Park Service stables. Reports indicate that rock debris landed on the Valley Loop trail behind the stables.

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2005011101 Merced River Gorge El Portal RS Winter 1/11/2005 small

Report from Park Dispatch of rocks on Highway 140 between Crane Creek and Yosemite View Lodge.

2005011601 Glacier Point Ledge Trail RF Winter 1/16/2005 small

Report from Park Dispatch of "extremely loud" rumbling sounds from the cliff below Glacier Point and above Curry Village, identified as coming from above the Curry Village amphitheater; the likely source area was above the Ledge Trail. It is unclear from the report whether the material was rock or ice. No fresh rock debris was located within the developed areas of Curry Village.

2005012701 Royal Arches Rhombus Wall RF Winter 1/27/2005 small

According to Valley Law Enforcement Ranger Todd Bruno (written commun., 27 January 2005): A rock fall occurred in the vicinity of Church Bowl. Eyewitness Marc LeMessurier observed the event from the Ahwahnee Hotel and observed about eight separate boulders (some "the size of porta-potties" [$\sim 2 \text{ m}^3$]) falling from the top of the western part of the Rhombus Wall, approximately from some lateral cliff bands well above the climbing route "Bishop's Terrace". LeMessurier reported that the rock fall lasted about 30 seconds. South and slightly east of the start of "Bishop's Terrace", Bruno observed several divots in the ground with associated flyrock fragments. Some of the flyrock extended south, over the trail that runs east/west through the area, a span of about 100 m from the base of the cliff. The trail was closed pending assessment. No information on possible triggers was provided.

2005032001 Wawona Road Grouse Creek RS Winter 3/20/2005 very small

Report from Park Dispatch of a rock slide on the Wawona Road 1 mile north of Grouse Creek, with a "5 foot diameter" boulder and associated smaller debris in the northbound lane.

2005032701 Merced River Gorge El Portal Road RF Spring 3/27/2005 very small

Report from Park Dispatch of a rock fall approximately 1.6 km east of the Arch Rock entrance station. The rock fall originated from quite high above El Portal Road and produced a 1.2 x 1 m boulder that landed in the eastbound lane, temporarily blocking traffic.

2005033001 Glacier Point Staircase Falls RF Spring 3/30/2005 small

Report from Park Dispatch of a rock fall from Glacier Point, above the west end of Curry Village. An National Park Service employee witnessed the rock fall from the Campground Reservation office near Curry Village and reported dust near the west end of Curry Village east of Staircase Falls. An exact source area was not reported. There were no reports of injuries, damage, or fresh rock debris in Curry Village.

2005041701 Yosemite Falls n/a RF Spring 4/17/2005 small

Report of rock fall sounds from the vicinity of Yosemite Falls. No further information is available.

2005050901 Merced River Gorge Big Oak Flat Road RF Spring 5/9/2005 very small

Report from Park Dispatch of a "2 by 3 foot rock" on the westbound lane of the Big Oak Flat Road, approximately 1.6 km up the road from the junction with the El Portal Road, which temporarily blocked traffic.

2005051401 El Capitan Nose RF Spring 5/14/2005 small

Numerous visitor reports of a rock fall from El Capitan. Initial reported locations ranged from the southeast face to the southwest face of El Capitan, but National Park Service responders subsequently confirmed that the rocks originated from near "The Nose" climbing route, and that rocks cleared Sickle

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Ledge on the Nose Route. Although there were many climbers on The Nose route at the time, there were no injuries.

2005051501 Glacier Point Happy Isles RF Spring 5/15/2005 small

Report from Park Dispatch of a small rock fall from Glacier Point, in the vicinity of Happy Isles. An exact source area was not reported.

2005061901 Half Dome Porcelain Wall RF Spring 6/19/2005 medium

According to Valley Law Enforcement Ranger K. Kowalewski (written commun. June 2005): John Dill (YOSAR) reported a rock fall in the Mirror Lake area that generated a large dust cloud. The rock fall originated from the Porcelain Wall just beneath the Diving Board on the western shoulder of Half Dome. Rock debris did not reach the Mirror Lake loop trail on the east side of the lake, nor did it reach the climber's trail leading to the base of Half Dome.

2005070101 Half Dome Half Dome RF Summer 7/1/2005 medium

According to Jim Roche, Acting Park Geologist (written commun., July 2005): A rock fall occurred from the northwest face of Half Dome. Analysis of before-and-after photographs revealed that the source area for the rock fall was on the upper eastern side of the failure area active in June 2003. The failed slab was a relatively thin (~1 m thick) flake that was bounded on the east and west by areas that had failed in 2003, and bounded on the top and bottom by obvious cracks, suggesting that the flake was mostly detached along a sheeting joint prior to failure. The volume of the flake was approximately 40 m³. The weather at the time of failure was dry and warm. No trigger is recognized, although thermal stress is a possible triggering mechanism in this case.

2005071601 Glacier Point Happy Isles RF Summer 7/16/2005 very small

According to Jim Roche (written commun. July 2005): Two rock falls occurred on 16 July 2005 below Glacier Point in the Happy Isles area. The first rock fall occurred just before 9:30 AM PDT and was reported to originate from the same location as the 10 July 1996 Happy Isles rock fall [IDs 1996051601-1996071102]. Valley Law Enforcement Ranger Loren Fazio, responding to the incident, reported no visible sign of flyrock reaching the road and no damage to any infrastructure. The Happy Isles Nature Center reported a second rock fall around 10:30 AM PDT. The horse trail and road to the water tank on the west side of the Merced River were closed until inspection of the area could take place. The Nature Center closed as well. On 17 July 2005, Ranger Chad Andrews and Acting Park Geologist Jim Roche viewed the cliff from a helicopter. The source area appeared to have been located at the southern edge of the 10 July 1996 Happy Isles rock fall scar. Freshly broken rock was visible on the failure plane left by the 1996 event and piled on some roots immediately below the initiation point. Most pieces of rock were 1-2 m in diameter or smaller. No water was observed on or near the detachment surface, and the weather was otherwise warm and clear.

2005071602 Glacier Point Happy Isles RF Summer 7/16/2005 very small

See ID 2005071601

2005100001 Union Point Union Point RF n/a 10-7/n/a/2005-2006 very small

According to Park Geologist Greg Stock: A rock fall was reported by National Park Service Facilities staff from the boulder-covered hillslope above the water line supplying late-season water to Glacier Point, somewhere between the Union Point source east of Sentinel Rock and the top of the Four Mile Trail. The rock fall damaged the water line when the line was shut off for the season (between October 2005

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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and July 2006), and the damage wasn't recognized and repaired until July 2006. The exact timing is unknown, therefore the trigger is unknown.

2005102501 Glacier Point Staircase Falls RF Fall 10/25/2005 medium

According to Jim Roche, Acting Park Geologist (written commun., October 2005): "A medium-sized rock fall occurred at Glacier Point at about 3:45 PM PDT on 25 October 2005, originating approximately 800 feet above the valley floor, immediately west of the Curry Village hard-sided cabins. Yosemite Protection and Fire personnel responded and evacuated guests, employees, and construction contractors from the hard-sided cabins area and from the [Curry Village Residential Area] construction site. One construction employee was indirectly injured, receiving minor injuries while fleeing the rock fall. All hard-sided cabins were evacuated and [temporarily] closed, as was the construction area, and the area cordoned off. A quick survey of the area later that afternoon revealed that fly rock from the rock fall had penetrated well into the cabin and construction areas... Fly rock was observed in... the Curry [Village Residential Area] construction area. Clast sizes ranged from 3-40 cm (median diameter) in the cabin and construction areas. Rocks in the 60-200 cm diameter range were found 20-30 meters upslope of... the new maintenance building for the [Curry Village Residential Area]. Two clasts sized 25 and 15 cm in diameter were found inside the frame of Building 9 in the [Curry Village Residential Area] construction area. One of the clasts had caused structural damage to the structure... Tim Ludington and Jim Roche observed the release point and slide path during a helicopter reconnaissance at approximately 10:30 am on the morning of 26 October. The release point contained some residual broken rock which could continue to fall, though its effect likely would be limited to the talus slope. Small roots lined much of the release area and no flowing water was visible. The Yosemite Valley weather station had recorded 0.41 inches [1 cm] of rainfall early on the morning of 25 October, which may have been a contributing factor in the release. A joint set dipping to the east directed the fall in that direction... An eyewitness, Jeff Pruitt, described hearing a low "roaring sound" and looking up to see an intact block begin to slide down the cliff face. After falling about 200 feet, it impacted one of the east-dipping joint controlled ledges and fragmented into "5-6 large pieces". These pieces then impacted a second east-dipping ledge, disintegrating into a large dust cloud that obscured further observation by Pruitt. The dust cloud coated cars in the parking area and hung in the air for approximately 20 minutes..."

2005112901 Wawona Road Turtleback Dome RF Fall 11/29/2005 very small

According to Jim Roche (written commun. 5 December 2005): A rock fall occurred [onto the Wawona Road] about 0.25 mile south of the service road to Turtleback Dome. It was reported at 03:30 by an National Park Service Roads employee on his way to Fresno. Tim Ludington inspected the initiation point and found to be pretty clean... Several cubic yards of slide material were removed from where it had partially blocked the road.

2005120101 Merced River Gorge El Portal RS Fall 12/1/2005 very small

According to Jim Roche, Acting Park Geologist (written commun., 5 December 2005): "A small rock slide occurred sometime before 06:30 on Foresta Road just east of its junction with Barium Mine Road, from the steep slopes above the road and below the Barium Mine entrances. Several cubic yards of material were removed from where the slide partially blocked the road."

2005120201 Half Dome Half Dome RF Fall 12/2/2005 small

According to Valley Law Enforcement Ranger Todd Bruno (written commun., 2 December 2005): A rock fall occurred from near the top of the northwest face of Half Dome. Witnesses in the Mirror Lake area report seeing "car-sized" boulders falling for up to one minute from the high point northeastern side

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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(left side as viewed from Mirror Lake). An exact source area was not reported. This area of the summit consists of numerous closely spaced slabs separated by sheeting joints, and the failure likely consisted of one or more of these slabs. Precipitation is considered to be the most likely trigger.

2005120202 Yosemite Falls Forbidden Wall RF Fall 12/2/2005 small

According to Valley Law Enforcement Ranger Todd Bruno (written commun., 2 December 2005): A rock fall occurred in the Yosemite Falls area, described as occurring somewhere between Upper and Lower Yosemite Falls. The rock falls was not observed, but rock fall sounds emanating from that area lasted about 45 seconds. No fresh rock debris was found on the Lower Yosemite Falls area. Rangers walked the Upper Yosemite Falls trail the following day and found several large blocks in the trail where the trail turns north towards the falls. They closed the trail using a gate near the location and inspected and reopened the trail on 5 December 2005.

2005120301 Indian Canyon Castle Cliffs RF Fall 12/3/2005 small

According to Valley Law Enforcement Ranger Mike Siler (written commun., 3 December 2005): A rock fall occurred in the Indian Canyon area. Rock fall sounds lasting 5-10 seconds were heard by several people in Yosemite Village and upper National Park Service housing, and a resident in concessionaire housing near Ahwahnee Meadow observed a dust cloud. The rock fall was reported to have originated from the north wall of Indian Canyon, just west of the creek bed. No fresh rock debris was found on the Valley Loop trail in the vicinity of upper National Park Service housing and the Medical Clinic.

2005121801 Merced River Gorge El Portal Road/Arch Rock RS Fall 12/18/2005 small

Report from Park Dispatch of rock debris on El Portal Road in the vicinity of Arch Rock. The rock originated from the hillslope on the north side of the road and consisted of several blocks up to 2 m³.

2005123101 Merced River Gorge Big Oak Flat Road RS Winter 12/31/2005 very small

Report from Park Dispatch of a very small rock fall onto Big Oak Flat Road.

2006020001 Rancheria Mountain Piute Creek DF Winter - Spring 2-4/n/a/2006 large

From Jim Snyder (written commun., 27 January 2011): "There was a debris flow off the east flank of Rancheria Mountain entering Piute Creek about a mile upstream from Pate Valley [evidence of this flow was observed on 19 September 2006]. The debris flow seems to have consisted more of mud and small rock fragments than large rock fragments. The exact source area on Rancheria Mountain could not be determined. The flow came down the mountain and entered an area along Piute Creek thick with vegetation. The flow tore through these smaller trees, abrading them heavily, uprooting some, and also moving large logs downstream, leaving piles of sand and small rock fragments in its wake. It broke into at least two channels in the area of the thick, smaller trees. The debris flows were ~5-6 feet in depth and a dozen or more feet across. The channels varied frequently between deeper/narrower and wider/shallower. The thinner material did not leave debris levees on either side but did spread out here and there in the thick vegetation. Upon entry into Piute Creek the flow gouged at the channel and banks, leaving tons of material in its downstream wake. The debris flow seemed powerful enough even to have altered the course of Piute Creek a little by forcing the main stream more to the rocky east side of its channel. Had this debris flow occurred during the 22-25 July 2006 storm [which initiated several debris flows from the south wall of the canyon; see IDs 2006072201-2006072205], the trees would have already leafed out, but the trees killed by this debris flow had not even begun to bud. For this reason, the Piute Creek event probably occurred earlier, in the late winter or early spring of 2006."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2006020201 Yosemite Falls Sunnyside Bench RF Winter 2/2/2006 small

According to Park Geologist Greg Stock: Numerous parties, including Stock, reported a rock fall east of Lower Yosemite Falls and north of the National Park Service Lower Housing area. Several loud booming sounds were heard, followed by sounds of individual rocks falling; however, the cliff was not observed due to darkness. No rocks were found on nearby roads or Valley Loop Trail, and subsequent observation the following day failed to yield a confirmed source area. Fresh rocks and broken manzanita bushes in the gully behind the National Park Service stables leading up to Sunnyside Bench suggest the source area was on Castle Cliffs, with an approximate volume of 5 m³. Temperatures at the time of the rock fall were below freezing, with light rain occurring earlier in the day; thus, precipitation and/or freeze/thaw are considered possible triggering mechanisms.

2006020301 Glacier Point LeConte Gully RF Winter 2/3/2006 small

According to Valley Law Enforcement Ranger Mike Siler (written commun., 2 February 2006): A small rock fall occurred from Glacier Point near LeConte Gully. Reconnaissance of the roads near LeConte Memorial Lodge and the Curry Housing area did not reveal any fresh rock debris.

2006022201 Yosemite Falls Yosemite Falls Trail RF Winter 2/22/2006 small

According to Barbara Buettner, National Park Service archeologist (written commun., February 2006): A small, single rock fall occurred from the cliff between Camp 4 and the Yosemite Falls Trail. The rock debris stayed on the talus slope, and the approximate volume was less than 10 m³. The temperature was below freezing; freeze-thaw and/or thermal stress are possible triggers.

2006022202 Yosemite Falls Yosemite Falls Trail RF Winter 2/22/2006 small

According to Park Geologist Greg Stock: A small, single rock fall occurred from the gully west of Upper Yosemite Falls containing the upper portion of the Yosemite Falls Trail. The event was heard but not observed, and based on the sound description the rock fall consisted of a single falling boulder that was less than 10 m³ in volume. Freezing conditions were present at the elevation of the rock fall, suggesting a possible freeze-thaw and/or thermal stress trigger.

2006022701 Merced River Gorge Big Oak Flat Road RF Winter 2/27/2006 extremely small

According to Park Geologist Greg Stock: A small "toaster-sized" rock fall was reported on the El Portal Road west of the junction with Big Oak Flat Road. Jim Cyr, National Park Service Roads, cleared the rock and speculated that it initiated from at or above the level of the Big Oak Flat Road. Heavy rain was falling at the time of failure; precipitation is the most likely trigger.

2006022702 Merced River Gorge Big Oak Flat Road RF Winter 2/27/2006 very small

According to Park Geologist Greg Stock: A boulder with dimensions 1 x 1.5 x 1.5 m (2.3 m³) fell on Big Oak Flat Road just above the junction with El Portal Road. Small rocks that fell from a head wall about 40 m above the road likely dislodged the larger rock that landed on the road. Rain at the time of failure was intense; precipitation is the most likely trigger.

2006032701 Union Point Chapel Wall RS Spring 3/27/2006 small

According to Park Geologist Greg Stock: A rock fall occurred from above the Chapel Wall southeast of the Chapel. Numerous witnesses observed the event from Sentinel Bridge, and it was heard throughout the eastern part of the valley. Witnesses in the Yosemite Research Library described 10-15 seconds of rumbling. The source area was above a section of steep cliff on a snow-covered boulder slope with trees. Rocks appear to have slid from the source area down the snow-covered slope. Below the source area were two distinct slide paths separated by a short headwall. From here, the debris slid off the rim

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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and free-fell to the talus slope below. The debris did not reach the Valley Loop Trail. The weather was warm for March (in the 50s degrees Fahrenheit), cloudy, and windy with a storm approaching. Freeze-thaw and/or snowmelt are possible triggers.

2006032702 Union Point Chapel Wall RS Spring 3/27/2006 very small

According to Park Geologist Greg Stock: A second rock fall from the same location of the 27 March 2006 11:40 PST event [ID 2006032701] from above the Chapel Wall occurred at 14:30 PST. A single boulder, approximately 2-3 m³, fell from the same source area, slid down the snow slope above the cliff, and then free-fell to the talus. Stock witnessed this event from Sentinel Bridge.

2006040301 Union Point Four Mile Trail DS Spring 4/3/2006 small

According to Park Geologist Greg Stock: Loud rumbling was reported in the vicinity of the Four Mile Trail, but rain and low clouds obscured the view of the cliffs. Stock, along with Jim Cyr, National Park Service roads foreman, checked roads and trails in the area but found no fresh rock debris. This event was possibly a snow avalanche or more likely a debris slide from the weathered material on the ridge west of Sentinel Rock near Sentinel Creek.

2006040401 Glacier Point Glacier Point Apron RF Spring 4/4/2006 small

According to Park Geologist Greg Stock: A rock fall was reported from the western side of the Glacier Point Apron, southeast of the Curry Village Terrace area. Low clouds prohibited observation of the cliff, and an exact source area could not be determined. No fresh rock debris was found on the talus behind Boys Town in the southeastern portion of Curry Village. The volume is unknown, but likely less than 10 m³. There was intense, prolonged rain the previous night; precipitation is the most likely trigger.

2006040402 Merced River Gorge Big Oak Flat Road RF Spring 4/4/2006 very small

According to Park Geologist Greg Stock: Several small boulders (~1 m³) fell onto the Big Oak Flat Road just east of the lower (easternmost) tunnel. The source area was from above the road cut in this area. Precipitation was the most likely trigger.

2006040501 Merced River Gorge El Portal Road / Windy Point RS Spring 4/5/2006 small

According to Park Geologist Greg Stock: A rock slide occurred on El Portal Road at Windy Point, about 2 km east of the park boundary. The source area was approximately 18 m above the road bed at the top of a road cut. The total volume was approximately 36 m³, with several individual boulders up to 1 m³ in volume. The boulders were highly weathered / grussified, and the slide debris included a substantial amount of grus and soil. The event followed intense morning rain, with 2 days of rain preceding the slide, and lowering temperatures. Water was seeping from joints diagonal across the cliff face below the source area at the time of failure, and the detachment surface was wet. Precipitation was the most likely trigger.

2006040601 Wawona Road Grapevine RS Spring 4/6/2006 very small

According to Park Geologist Greg Stock: A rock slide occurred about 1 km north of Wawona Campground near "Grapevine". The rock slab was approximately 1 x 3 x 1 m (3 m³) and fell onto both lanes of the road from the top of an approximately 15 m high road cut. Rocks from the source area, the contact between Gateway Tonalite and a small septa of metamorphic schist / quartzite, rolled down a gully before landing on the road. The rock was densely fractured and highly weathered / grussified at this site. The event followed several days of intense rain; precipitation was the most likely trigger.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2006040602 Merced River Gorge El Portal Road/Windy Point RS Spring 4/6-7/2006 small

According to Park Geologist Greg Stock: A rock slide occurred on the El Portal Road about 1 km east of the park boundary. The source area was about 10 m above the road, from the roadcut. The debris in the turnout had dimensions approximately 5.5 x 2.3 x 0.8 m (10 m³) and was mostly grussified Gateway Tonalite. The debris consisted mostly of grus and soil with two blocks approximately 30 cm on a side. The weather was clear and sunny, but followed several days (and months) of rain. Water running from the cliff suggest saturated conditions within the grussified material that failed.

2006040603 Merced River Gorge El Portal Road/Windy Point DS Spring 4/6-7/2006 medium

According to Park Geologist Greg Stock: A large debris slide and adjacent smaller debris slide occurred on the south side of the Merced River, opposite the El Portal Road and just downstream of Windy Point. The material was mostly colluvium (mud, gravel, boulders) with very little bedrock. Several trees were uprooted. The volume of material transported in the two adjacent slides was approximately 400 m³.

2006043001 Glacier Point Happy Isles RF Spring 4/30/2006 small

According to Valley Law Enforcement Ranger Manseau (written commun., 30 April 2006): Two small rock falls occurred from Glacier Point on 30 April 2006, the first at 08:20 PDT and the second at 09:30 PDT. The first was described as a "loud rock fall lasting approximately 45 seconds". The second was described as lasting about 15 seconds and occurring "on top of Glacier Point Apron east of the Wilderness Parking Lot". Manseau checked roads in the Happy Isles area and did not find any rock debris, and noted that there was no dust in the air. The source area was estimated to be within or very near the 1996 Happy Isles rock-fall source area. The cumulative volume of the two events was approximately 10 m³. No triggers were recognized.

2006043002 Glacier Point Happy Isles RF Spring 4/30/2006 small

See ID 2006043001

2006050401 Merced River Gorge Big Oak Flat Road RF Spring 5/4/2006 small

According to Park Geologist Greg Stock: A rock fall occurred just east of the lower (easternmost) tunnel on Big Oak Flat Road. Several boulders up to about 0.8 m³ fell on the road, slightly damaging a constructed rock wall on the south side of the road. At least one impact crater was noted on the south side of the road, although there was no evidence of impact on the roadway at this location, indicating that the boulder was airborne entirely over the roadway. Park Geologist Greg Stock and Tim Ludington (National Park Service Road and Trails) located the source area about 100 m above the road on the east wall of a small unnamed drainage. The failed rock mass was a flake approximately 3 x 5 x 2 m (30 m³) that toppled from a small headwall about 8 m above the drainage. The flake broke into many pieces on impact at the bottom of the headwall and tumbled down the drainage and onto the road. The detachment surface was clean of additional rock debris after the failure, with water seeping down it. Precipitation may have been a trigger.

2006050701 Cathedral Rocks Lower Cathedral Rock RF Spring 5/7/2006 small

According to the Supertopo.com forum (written commun., 9 May 2006): A rock fall originated in the small gully toward the east side of Lower Cathedral Rock but west of the Gunsight. Several climbers witnessed the event from El Capitan, and reported boulders "up to the size of VW's coming down [presumably Volkswagen vans], along with huge trees and logs". The volume was likely approximately 20 m³. A trigger was not recognized.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2006052101 Merced River Gorge Reed's Pinnacle RF Spring 5/21/2006 very small

According to Park Geologist Greg Stock: A 1.5 x 1 x 0.5 m (0.75 m³) block fell onto Big Oak Flat Road from the road cut between the lower (easternmost) and middle tunnels, near the Reed's Pinnacle climbing area. The event was likely triggered by about 2.54 cm of rain that fell during a late May rainstorm.

2006061001 Half Dome Northwest Face RF Spring 6/10/2006 small

According to Park Geologist Greg Stock: Report of a rock fall from the Northwest Face of Half Dome. Climbers approaching the face from the slabs south of Mirror Lake witnessed several rocks falling from the face and tumbling down the gullies below the face, narrowly missing them on the slabs. The source area appears to be the same as that producing rock falls in 2003 [ID 2003060601 -2003062901]. Based on the climber's description, the cumulative volume of the rock fall is estimated at between 5-10 m³.

2006061101 Panorama Cliff Nevada Fall RF Spring 6/11/2006 small

According to Park Geologist Greg Stock: A rock fall occurred at the first switchback of the John Muir Trail after the junction with the Mist Trail and just below Panorama Cliff. The source area was about 50 m west of the 17 July 2003 rock fall source area [ID 2003071701]. The volume was approximately less than or equal to 10 m³. The weather was clear and sunny with mild temperatures, and the source area was dry; trigger was unrecognized.

2006062301 Panorama Cliff Nevada Fall RF Summer 6/23-25/2006 extremely small

According to Park Geologist Greg Stock: Rocks on the John Muir Trail were reported near Valley View, the westernmost switchback west of Porcupine Spring. The report described several rocks on the trail that could be moved by hand. The volume was approximately less than 0.5 m³. The trigger was unreported.

2006072201 Grand Canyon of Tuolumne Muir Gorge DF Summer 7/22/2006 very large

(1) According to Tim Ludington, National Park Service Trails foreman (oral commun., July 2006): A substantial debris flow occurred in the Grand Canyon of the Tuolumne River, approximately 1.5 to 2 miles upstream of Pate Valley. Ludington reported a new deposit of sand, gravel, cobbles, and small boulders at the mouth of an unnamed channel on the south side of the Tuolumne River upstream of Pate Valley and headed approximately below Double Rock. (2) According to Jim Snyder (written commun., January 2011): "One and a half to two miles upstream from Pate Valley on the Tuolumne River at about Mile 132, there were at least four debris flows during the storm lasting from 22-25 July [see item (3)]. The largest debris flows came from the north-facing canyon walls above the river, beneath Double Rock. The walls on the north-facing side in this vicinity are higher than walls just north of the river, contributing more rock debris to the slopes there and capable of gathering more water in runoff and storms than the south-facing wall at Mile 132. The south-facing wall is mostly exposed, glaciated bedrock running into the river with little talus accumulation. The north-facing wall has much more talus accumulation by comparison and much more of the slope is forested. At the top of the vegetated talus there are numerous rock fall and debris channels coming out from the cliffs and penetrating the vegetated talus to varying degrees. Breaks in the vegetation near the top of the talus indicate constantly changing channel courses moving around previously deposited material. Only two of these seem to have reached the river prior to the 22-25 July 2006 storms. Of the two debris flow channels that show on earlier aerals, the easternmost enters the river at about UTM 274190 E and 4200720 N. I did not examine this channel on the ground. It appears in the 1955 aerial to be open but partially overgrown in comparison with the 1997 aerial photograph. Nevertheless, it regularly contributes debris to the river, enough that it has partially dammed the river to create a beautiful long

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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pool below the trail, which must climb the exposed cliff above it to get around this part of the river. The channel comes from far up the slope and appears ordinarily to be full of loose rock and debris. It is quite possible that this channel also delivered a debris flow to the river in July 2006." (3) Maps of lightning strikes from 22-25 July 2006 show numerous strikes in the vicinity of Double Rock on the afternoon of 22 July 2006, suggesting that an intense thunderstorm on that date likely triggered the debris flows in the Tuolumne River canyon.

2006072202 Grand Canyon of Tuolumne Muir Gorge DF Summer 7/22/2006 very large

From Jim Snyder (written commun., 27 January 2011): "Two new channels cut into the slope above the Tuolumne River during the 22 July 2006 storm came from the same source on the cliff as the largest debris flow (see ID 2006072201). The uppermost channel (Mile 132A) entered the river at roughly UTM 274500 E and 4200760 N, while the larger channel just west (Mile 132B) entered the river at roughly UTM 274400 E and 4200720 N. These channels may have been controlled in part by huge rock fall blocks in the talus. These channels emanate high on the cliff on steep bedrock slopes that hold some rock debris but that also can quickly accelerate rapid runoff. A great deal of the rock debris blocks the water as it hits the lower angled talus, causing water and rock to seek places to go. The constant moving of water and rock near the top of the talus has created a myriad of channels down the talus very similar to the vegetated talus of the Sentinel Creek fan or the Taft Toe fan in Yosemite Valley. The channel of 132B seems to have been the larger and deeper of the two, carrying and depositing greater loads through both of the forks at its mouth. The two openings of 132B also dammed the river enough to force it up on the Tuolumne Canyon trail. In the case of the debris flows at Mile 132, the talus here is formed in part by rock fall debris but also in part by debris flows. This combination of depositional origins is likely responsible for the lower angle of repose in this talus than in others for which rock fall seems the dominant source."

2006072203 Grand Canyon of Tuolumne Muir Gorge DF Summer 7/22/2006 very large

From Jim Snyder (written commun., 27 January 2011): "Another small debris flow triggered by the 22 July 2006 storm occurred from a relatively short channel at Tuolumne River Mile 132C. This debris flow entered the river at about UTM 274150 E and 4200050 N. Most of the material from this debris flow appears to have been mobilized toward the lower end of the channel rather than all along it, probably because of the less steep [compared to the channels described in IDs 2006072201 and 2006072202] descent of the channel."

2006072204 Grand Canyon of Tuolumne Muir Gorge DF Summer 7/22/2006 large

From Jim Snyder (written commun., 27 January 2011): "Another debris flow triggered by the 22 July 2006 storm occurred on the north side of the Tuolumne River, crossing the trail at approximately UTM 274250 E and 4201050 N. This debris flow was smaller [than those described in IDs 2006072201-2006072203] because it came from a south-facing slope that harbors less debris and vegetation. The debris flow came out of apparently near-vertical joints behind and adjacent to a small dome about 5,600 feet in elevation. This debris flow carried smaller and less material than its neighbors upstream. The bedrock over which the trail passes made it possible for the debris flow to sweep more material into the river, though much was still held behind by small ledges or irregularities in the rock. This debris flow may represent a convergence of material from several sources, and it may also have forked and moved around on the bedrock during the event, leaving scattered remnants behind."

2006072205 Grand Canyon of Tuolumne Muir Gorge DF Summer 7/22/2006 medium

From Jim Snyder (written commun., 27 January 2011): "The trail along the Tuolumne River from the swamp lake to the forested overflow area below the bridges is another area of the north-facing side of

the Tuolumne Canyon where talus is the product of both rock falls and debris flows. There are a series of debris flow channels along this section of the trail. Several cross the trail down from the swamp lake. The first two or three carried debris flows from the winter 1964 flood, and my trail crew tried to repair the trail through them and clear the channels in the vicinity of the trail in summer 1966 in preparation for the next event. The one channel that had a smaller debris flow in July 2006 was just beyond Mile 129 of the Tuolumne River at approximately UTM 270820 E and 4200640 N on the trail. This channel crosses the trail where a long section of the trail is on a loose slope right along but well above the river. The 22 July 2006 debris flow was not large enough to climb over the existing banks, but it did mobilize quite a bit of material in the channel and sent it down the cliff into the river, leaving a very rough trail crossing."

2006072701 Union Point Four Mile Trail RF Summer 7/27/2006 small

According to Park Geologist Greg Stock: A small rock fall occurred above the Four Mile Trail from approximately 1,700 m elevation. The source area was near the top of a prominent cliff band east of Sentinel Rock that diagonals up to the east above the trail. Yosemite Search and Rescue eyewitnesses describe an initial rock several cubic meters in volume that fell from the cliff band, generating a dust cloud, and then moved down into a gully, dislodging additional loose debris. At least two boulders fell onto the talus slope below the gully. Rocks went over two sections of the Four Mile Trail, but no injuries or trail damage was reported. The cumulative volume was approximately 15 m³. The weather was clear, sunny, and hot; no specific trigger was recognized, but thermal stress may have played a role.

2006072702 Half Dome Northwest Face RF Summer 7/27/2006 large

According to Park Geologist Greg Stock: A large rock fall occurred from relatively low and slightly southwest on the broad northwest face of Half Dome, above "Bushido Gully", which is the narrow gully at the base of the northwest face on the southwest side of the face. The rock fall consisted of a slab approximately 35 x 7 x 2-3 m (735 m³, assuming a 3 m thick slab). After detaching along a sheeting joint from beneath a prominent curving arch, the slab slid down a steeply inclined surface for 60-80 m and then impacted a lower-angle section of the face where the rock began to break apart. The rocks then fell into Bushido Gully and the central gully beneath the northwest face, producing a substantial dust cloud that was observed throughout eastern Yosemite Valley and Tenaya Canyon. Several boulders fell down to the floor of Tenaya Canyon, and subsequent investigation revealed fresh boulders up to 1 m in diameter on the talus slope at the base of the central gully. The rock fall substantially altered the lower pitches of the climbing route "Promised Land", which ascends along the western side of the failed slab. This event was the largest in a series of rock falls that occurred over many days. A climber witnessed the first rock fall in the series on 20 July 2006 and observed more events on 25 July 2006. Climbers report hearing minor but steady rock falls for the next two days until the large source, and also observed another slab approximately 3 x 1 x 2 m fall the day following the large rock fall. This account suggested the rock falls occurred as a progressive failure of the large flake underneath the arch. When the source area was observed from a helicopter approximately 75 minutes after the event, the area was dry, but dark water stains were present on the detachment surface, indicating at least seasonal flow of water through the sheeting joints that formed the back side of the failed slab. The detachment surface showed staining over most of its surface area, with only freshly broken surfaces along the edges, suggesting the flake was detached over much of its ~35 m horizontal span and only pinned at the edges prior to failure. Yosemite Valley experienced several days of thunderstorms prior to the event, with some precipitation at Half Dome; however, water flow is not specifically identified as a trigger because the rock-fall detachment surface was dry when observed approximately 45 minutes after the failure. Stress redistribution and progressive destabilization resulting from earlier rock falls may have contributed to failure, but a specific triggering mechanism for this rock fall is not recognized. However,

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the fact that the rock fall occurred near the end of a very hot summer day, when the northwest face receives full sun, suggests that thermal stress (expansion and contraction of the relatively thin flake) may have played a role in triggering the rock fall.

2006080501 Glacier Point Curry Village RF Summer 8/5/2006 small

According to Park Geologist Greg Stock: A rock fall occurred on the western side of Glacier Point from above the eastern side of the Curry housing area under construction and the western side of the Curry hard-sided cabins. A witness (Richard Valley, construction contractor) saw dust and four boulders rolling down the talus slope below the cliff; all boulders stopped on the talus slope. The approximate volume was 10 m³. The source area was unknown, but it may have been from the Staircase Falls area, specifically from debris perched on ledges beneath the 2003 source area, from the cliff west of the falls. No trigger was recognized.

2006080601 Merced River Gorge Elephant Rock RF/DS Summer 8/6/2006 medium

According to Park Geologist Greg Stock: A medium-sized rock fall occurred from the west face of Elephant Rock in the Merced River Canyon downstream of Yosemite Valley. A large slab of rock, approximately 15 x 10 x 2 m (300 m³), detached from high on the west face in the upper east portion (upper left portion when viewed from the Merced River) of the March 1971 rock-fall scar. The slab slid off the north-dipping detachment surface, free-fell about 50 m to a series of steeply sloping ledges, and broke into a number of fragments upon impact, generating a large dust cloud. Rock fragments, some several meters on a side, proceeded to tumble down the steep talus slope and initiated a small debris slide. These fragments traveled down slope to the Merced River, and fishermen in the river below Elephant Rock witnessed "microwave-sized" boulders splashing into the river. Fisherman Herb Dunn captured a sequence of impressive photographs of the rock fall and subsequent debris slide, which were posted on geology.com. The rock fall was a clean detachment along a roughly surface parallel sheeting joint, with only subtle staining and weathering of the rock around the margins of the detachment surface, suggesting fresh cracking along most of the detachment surface. The air temperature during the event was very warm (~90 degrees Fahrenheit), and Elephant Rock receives direct sunlight in the afternoon, suggesting that rock surface temperatures were considerably warmer. In light of the absence of other possible triggering mechanisms such as seismicity, precipitation, or freeze-thaw conditions, and in light of the very warm temperatures at the time of failure, thermal stress is considered to be the most probable triggering mechanism.

2006080701 Yosemite Valley n/a RF Summer 8/7/2006 small

According to Park Geologist Greg Stock: Stock awoke in the National Park Service Lower Housing area to a loud "boom" sound very likely related to a rock fall somewhere in eastern Yosemite Valley. No source area or fresh debris was identified.

2006082101 Half Dome Northwest Face RF Summer 8/21/2006 small

According to Christine Loberg, National Park Service Interpretive Ranger (oral commun., 22 August 2006): A rock fall occurred from the northwest face of Half Dome. Loberg observed the rock fall from the Stoneman Meadow area during a Valley tram tour. She described a "small-to-medium-sized" rock fall that "put up dust". Her description of this location strongly suggested that this rock fall originated from the 27 July 2006 rock-fall source area. The weather was clear, sunny, and hot. A specific trigger was not recognized, but thermal stress may have played a role; furthermore, the failure was likely related to destabilization associated with the 27 July 2006 event.

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2006082201 Glacier Point n/a RF Summer 8/22/2006 small

According to Sam Vasquez, National Park Service Interpretive Ranger (oral commun., 22 August 2006): Vasquez heard a rock fall occurring from Glacier Point, perhaps above Curry Village. Vasquez heard a "gunshot" sound that was followed by the sound of tumbling rocks; however, he did not observe the event because it was dark. Subsequent analysis failed to reveal an exact source area. The volume was likely small, less than 5 m³. The trigger was unrecognized.

2006090501 Indian Canyon Indian Canyon RF Summer 9/5/2006 small

According to Park Geologist Greg Stock: Stock awoke to sounds of many rocks clattering from the vicinity of Indian Canyon. A specific source area in Indian Canyon was not determined. The volume was small and likely less than 10 m³.

2006092001 Indian Canyon Indian Canyon RF Summer 9/20/2006 small

According to Park Geologist Greg Stock: Park Dispatch reported a rock fall in or near Indian Canyon. The report stated 1.5 minutes of rock fall type rumbling was heard. No fresh rock debris or dust cloud was found after checking the Valley Loop Trail and National Park Service Upper Housing area.

2006092301 Merced River Gorge Elephant Rock RF Fall 9/23/2006 small

According to Park Geologist Greg Stock: Several park visitors in the pullout on the El Portal Road opposite Elephant Rock observed a rock fall from Elephant Rock that created a small dust cloud. Subsequent investigation revealed that the source was a small overhanging flake at the top of the fresh scar from the 6 August 2006 rock fall [ID 2006080601]. The flake was approximately 2 x 3 x 1-2 m (6-12 m³). The failure was likely related to the earlier rock fall, but may have been triggered by thermal stress. The weather was sunny, clear, and very hot.

2006092901 Royal Arches Rhombus Wall RF Fall 9/29/2006 very small

According to Valley Law Enforcement Ranger Todd Bruno (oral commun., 29 September 2006): A small rock fall occurred from the Rhombus Wall area north of the Ahwahnee. Bruno reported an approximately 2 m³ rock fall that generated a dust cloud on impact, but could not locate an exact source area. No trigger was recognized.

2006100601 Glacier Point Curry Village RF Fall 10/6/2006 small

According to Park Geologist Greg Stock: A rock fall occurred from the 1998-1999 Curry Village rock fall source area. Visitors staying in Curry Village heard a distinct "crack" or "pop" sound followed by rumbling like thunder that lasted about 10 seconds. Some visitors self-evacuated. The failure consisted of a rock slab approximately 3 x 5 x 2 m (30 m³) from within the 1998-1999 scar, up and left of the prominent white dike in a left-facing dihedral. The triggering mechanism was likely precipitation and/or freeze-thaw after the first cold winter storm of the season, with 0.48 cm of precipitation on 5 October and 0.74 cm of precipitation on 6 October 2006.

2006100602 Merced River Gorge El Portal Road / Arch Rock RF Fall 10/6/2006 extremely small

According to Park Geologist Greg Stock: Park Dispatch reported a "soccer ball-sized" (~0.2 m³) rock on the westbound lane of El Portal Road about 1.2 km west of the Arch Rock entrance station. The triggering mechanism was likely precipitation and/or freeze-thaw after the first cold winter storm of the season, with 0.48 cm of precipitation on 5 October and 0.74 cm of precipitation on 6 October 2006.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2006100603 Merced River Gorge Big Oak Flat Road RF Fall 10/6/2006 small

According to Park Geologist Greg Stock: A rock fall occurred on the Big Oak Flat Road east of the easternmost (lower) tunnel. Approximately 5 m³ of rock debris, in the form of 5 boulders, fell on the road. The largest boulder was approximately 1 m³ in volume. The source area was near the top of the head wall, about 45 m above the base of the cliff. A 3 x 2 x 1 m fresh boulder sat at the base of the cliff in a large impact, which damaged vegetation. Several more boulders moved down the talus slope among freshly broken trees and brush, including a group of boulders approximately halfway down the slope. The five boulders on the talus slope had dimensions of 1 x 1 x 2 m; 4 x 1 x 2 m; 1 x 0.5 x 0.5 m; 1 x 1 x 0.5 m; and 1 x 1 x 1.5 m. Cumulatively another 2 m³ of debris was deposited on the talus slope, for a total volume of approximately 15 m³ of debris on the slope (in addition to the 5 m³ of debris on the road). The triggering mechanism was likely precipitation and/or freeze-thaw after the first cold winter storm of the season, with 0.48 cm of precipitation on 5 October and 0.74 cm of precipitation on 6 October 2006.

2006111401 Parkwide n/a RF Fall 11/14/2006 very small

According to Park Geologist Greg Stock: Numerous small rock falls were reported during the night of 13 November and the morning of 14 November 2006. The rock falls occurred after about 12 hours of continuous rain totaling 3.8 cm. Locations of rock falls reported on roads include: Big Oak Flat Road (same site as 6 October 2006 rock fall consisting of small debris from the talus slope), Wawona Road near Grapevine, and Foresta Road between Rancheria and the water treatment plant. All of the rocks were very small and were quickly cleared. Precipitation is considered the most likely trigger.

2006112001 Rockslides Old Big Oak Flat Road RF Fall 11/20/2006 extremely small

According to Park Geologist Greg Stock: Park Dispatch reported three "basketball-sized" rocks on the Big Oak Flat Road about 0.25 km west of the junction with El Portal Road.

2007000001 El Capitan East Buttress RF Winter n/a/n/a/2007 medium

According to Park Geologist Greg Stock: A rock fall occurred from low on the southeast face of El Capitan, near the East Buttress. New large boulders were reported by National Park Service climbing ranger Jesse McGahey on the informal climber's path leading to the start of the East Buttress climbing route. Subsequent observation on 15 May 2007 located several fresh boulders, up to 4 m in diameter, on the climber path just west of the East Buttress start where the trail drops down a bit before climbing back up to the top of Schultz's Ridge. The volume was approximately 50 m³ based on the fresh talus. The rock-fall source area was only about 15-20 m above the base of the cliff, and consisted of a steeply dipping planar surface. The trigger is unknown, as the exact timing of this rock fall is unknown.

2007000002 Yosemite Falls Yosemite Falls RF n/a n/a/n/a/2007 small

Report from rock climber Eric Kohl of a rock fall from the low-angle rock "apron" just west of the base of Upper Yosemite Falls. In 2006 he climbed a route that involved climbing along the left of a 6 x 6 x 1 m flake. He described the experience as "really spooky knowing that the whole thing was cracked all around." The flake subsequently fell; repeat photography of the Yosemite Falls area constrains the rock fall as occurring between 14 February 2007 and 20 November 2007.

2007011501 Indian Canyon Castle Cliffs RF Winter 1/15/2007 small

According to Park Geologist Greg Stock: A rock fall from the Castle Cliffs north of the National Park Service stables occurred just after midnight. Numerous rock impacts sounded like thunder and lasted about 30 seconds. A second smaller rock fall consisting of a single boulder occurred at 01:19 PST. Inspection in the morning revealed a fresh boulder in the gully directly north of the stables leading up to

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Sunnyside Bench. Two large boulders totaling about 2 m³ were found resting approximately 100 m upslope of the Valley Loop Trail north of the National Park Service stables. One flyrock boulder, approximately 0.5 m³, fell onto the Valley Loop Trail in the talus slope section north of the stables. Considerable vegetation on the talus slope was damaged, with several live oaks completely shattered and many others broken and scarred. The weather was sub-freezing nighttime temperatures coupled with clear daytime skies and melting on south-facing cliffs, suggesting a freeze-thaw trigger. Roots were clearly visible at the source area west of Arrowhead Arête, suggesting an earlier root wedging component of destabilization.

2007012201 Yosemite Valley n/a RF Winter 1/22/2007 small

According to Park Geologist Greg Stock: Stock awoke to a distant booming sound accompanied by slight ground shaking at 00:48. Ten minutes later, at 00:58, a second, larger booming sound accompanied by stronger ground shaking occurred. The only other report of these events was from a guest at the Yosemite Lodge who inquired at the visitor center later that day. Subsequent investigation revealed no fresh rock debris on the valley floor, nor any obvious new rock fall scars. No debris was reported on any roads or trails. The most likely source area is in Tenaya Canyon, which is remote and difficult to access in winter.

2007021001 Merced River Gorge El Portal Road / Windy Point RS Winter 2/10/2007 very small

According to Park Geologist Greg Stock: Report of "basketball-sized" rocks (~0.5 m³) that fell onto the El Portal Road just east of Windy Point.

2007021002 Glacier Point Happy Isles RF Winter 2/10/2007 small

According to Park Geologist Greg Stock: A small rock fall occurred from the cliff between Washburn Point and Glacier Point, near Happy Isles. No fresh rock debris was found on the road to the water tank or the Fen Trail. An exact source area was not determined. The volume was approximately ≤10 m³. Precipitation was the most likely trigger.

2007021003 Glacier Point Staircase Falls RF Winter 2/10/2007 very small

According to Park Geologist Greg Stock: A small rock fall was reported from the vicinity of Staircase Falls. A bystander heard clattering of rocks for 5-10 seconds. The volume was approximately 2-5 m³. The trigger was likely precipitation, but may have also been freeze-thaw.

2007030001 El Capitan Ribbon Falls RF Winter 3/n/a/2007 small

According to Park Geologist Greg Stock: Stock hiked to the base of Ribbon Falls on 26 March 2007 and observed fresh rock fragments, including settled dust, and broken vegetation (oak, ponderosa pine, and cedar branches) in the amphitheater at the base of the falls. The freshness of debris and still-green vegetation suggested that the rock fall occurred within the previous few weeks, probably sometime in March. The source area was likely just west of the lip of the falls, where vegetation exists to be uprooted. The volume was less than 10 m³. The trigger was unknown because the exact timing of the event was unknown.

2007030002 Yosemite Falls Yosemite Falls Trail RF Winter 3/n/a/2007 very small

According to Park Geologist Greg Stock: Stock observed freshly disturbed ground, small fresh rock debris, and broken vegetation with faded green leaves on the Yosemite Falls Trail along the straight section leading to the base of the Upper Falls just north of the closure gate. The volume of fresh rock debris on and below the trail was approximately 2m³. The state of the broken vegetation suggested the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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event occurred sometime in March. Because the exact timing of the rock fall is unknown, the trigger is unknown.

2007030003 El Capitan Manure Pile Buttress RF Winter 3/n/a/2007 small

According to Park Geologist Greg Stock: Stock observed fresh boulders at the base of the gully on the east side of Manure Pile Buttress, about 30 m east of the direct start to the climbing route "Nutcracker". The debris consisted of three boulders totaling approximately 9 m³. Broken vegetation with faded green leaves suggest the rock fall occurred sometime in March. Subsequent investigation on 22 April 2007 identified the source area directly above the impact area, about 50 m above the ground. Based on the patterns of lichens and moss, the failed rock mass appeared to be precariously perched after an earlier fall, and toppled and fell from the source area.

2007031501 Taft Point Taft Point RF Winter 3/15/2007 medium

According to Park Geologist Greg Stock: A rock fall was reported as occurring near Taft Point. The witness observed the rock fall from near the river, just east of El Capitan, and described hearing a rumble that got louder and lasted about 30 seconds. A dust cloud focused near the rim of the valley lasted for 4-5 minutes before dissipating. A subsequent report described a dark streak on fresh snow below Taft Point and identified the rock fall source area between Profile Cliff and Taft Point, roughly one-third of the way down the cliff from the top. The volume was approximately 100 m³. The trigger was unrecognized, but may have involved snowmelt.

2007040001 Half Dome Mirror Lake Trail RF Spring 4/n/a/2007 medium

According to Park Geologist Greg Stock: Stock observed a fresh rock fall scar on 23 April 2007 at a point relatively low on the cliff south of Mirror Lake, at the very base of Half Dome. Fortunately, U.S. Geological Survey geologist Gerald Wieczorek had taken photos of Half Dome from Mirror Lake on 11 April 2007 that show the fresh rock fall scar. Thus, the event must have occurred prior to 11 April 2007. The source area had fresh rock with dirt on the sloping ledges. The debris fell a short distance and landed on the talus slope directly below the source area; debris did not extend to the base of the talus or the trail. The dimensions of the failed slab were approximately 6 x 12 x 4 m (288 m³). Because the exact timing of the rock fall is unknown, an exact trigger is unknown; however, water was seeping from the source area on 23 April, 28 April, and 29 April 2007, suggesting precipitation and/or snowmelt may have played a role.

2007041101 Glacier Point LeConte Gully RF Spring 4/11/2007 small

According to Park Geologist Greg Stock: A rock fall occurred from the cliff between LeConte Memorial on the west and LeConte Gully on the east. Very low clouds obscured the cliff, but several rocks falling down the middle third of the cliff were heard. Rock fall sounds lasted less than 10 seconds and the rocks did not reach the valley floor. Subsequent investigation on 12 April 2007 failed to reveal an exact source area, but was complicated by low clouds and wet rock surfaces. The volume was unknown, but estimated to be less than 10 m³. Precipitation was the likely trigger.

2007042301 Cathedral Rocks Lower Cathedral Rock RF Spring 4/23/2007 small

A rock fall was reported by Valley Law Enforcement Ranger Mike Foster from Lower Cathedral Rock. Foster was participating in a swiftwater rescue course on the Merced River where it crosses the El Capitan moraine below Lower Cathedral Rock when he heard several "popping" sounds and observed several "car-sized" blocks free-falling down the northwest face of Lower Cathedral Rock. Impacts on the upper talus produced loud "booming" sounds. Subsequent observation with a spotting scope from El Capitan Meadow revealed the source area within a dihedral approximately 200 m above the base of the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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cliff. The source area was fresh without lichen or brown staining. The failed rock mass was a vertically oriented slab $\sim 8 \times 2 \times 1.5$ m (24 m^3). The source area appeared relatively stable except for a few small flakes totaling less than 5 m^3 . The event followed 24 hours of medium to heavy rain (3.5 cm of precipitation on 22 April 2007). Precipitation is the most probable trigger, but freeze-thaw is also a possibility.

2007050401 Hetch Hetchy Wapama Falls RF Spring 5/4-5/2007 very small

According to National Park Service trail worker Douglas Matheson (written commun., May 2007): A rock fall occurred near Hetch Hetchy Reservoir, on the trail about 3/4 mile beyond O'Shaughnessy Dam and 1/4 mile before (west of) the Beehive/Wapama Falls trail junction. Two rocks, with volumes 1.8 m^3 and 1 m^3 , ended up on the trail. There were additional rocks that may have come from a retaining wall that was damaged by impacts. The weather was sunny and clear. No trigger was recognized.

2007051601 Yosemite Falls Camp Four Wall RF Spring 5/16/2007 small

According to Park Geologist Greg Stock: A climber reported a small rock fall from the wall north of Camp Four. The event consisted of about 5 seconds of boulder-clattering sounds which were likely several small blocks. The climber did not witness the event due to darkness, but the sound was loud enough to wake him up. Based on the description, the volume was estimated to be less than 10 m^3 . An exact trigger was not recognized.

2007060001 Tenaya Canyon Cloud's Rest RS Spring 6/n/a/2007 medium

According to Park Geologist Greg Stock: A medium-sized rock slide occurred from Cloud's Rest in the late spring of 2007 (exact date unknown, but likely in early June). Climber Sean Jones and his partner had just completed a new climbing route ("Laid to Rest") on the south face of the subdome on the east shoulder of Half Dome, and were standing on the summit when they observed a rock fall originating from near the top of Cloud's Rest on the south wall of Tenaya Canyon. Jones recounted the experience on a Supertopo.com Forum post: "When we topped out it was the perfect ending to the perfect Yosemite day. Right at sunset, blazing pink and orange skies, huge view up Tenaya Canyon... and the air was dead silent and dead still. We started on our way back to base camp and out of nowhere this huge [expletive deleted] rock slide just cut loose all the way from the top of Cloud's Rest and pulverized everything in its path all the way to the bottom of Tenaya Canyon. Huge dust plumes and total chaos. The dust settled and it was back to perfect silence as the black of night began to set in" (source: eyewitness report posted on Supertopo.com Forum). Given the report of clear, calm weather, and subsequent determination of no coincident seismic activity, a specific trigger is not recognized for this event. This rock slide was the likely source of fresh rock debris reported later in the summer and fall of 2007 by hikers descending Tenaya Canyon from Olmsted Point to Mirror Lake.

2007060101 Cathedral Rocks Lower Cathedral Rock RF Spring 6/1/2007 small

According to Park Geologist Greg Stock: A climber reported fresh rock debris in the "Gunsight", the prominent joint-controlled gully between Middle and Lower Cathedral Rocks, on 1 June 2007; the rock fall must therefore have occurred prior to that date, but as the report indicated that substantial dust coated adjacent surfaces, the rock fall likely occurred not long before that date. Based on the description of the extent of dust and fresh rock debris, the volume was estimated to be approximately $20\text{-}30 \text{ m}^3$. The trigger was unknown.

2007060901 Cathedral Rocks Middle Cathedral Rock RF Spring 6/9/2007 small

According to climber posts on the Supertopo.com forum (written commun., 18 June 2007): A rock fall occurred in the night from on or near the "Direct North Buttress" climbing route on Middle Cathedral

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Rock. Witnesses on El Capitan reported that it "looked like a bunch of sparks going off, then we hear[ed] the fall, and saw a pretty good dust cloud arise". Subsequently, visitors to the base of Middle Cathedral reported many smashed trees and fresh rock debris. The volume was approximately 20 m³. No trigger was recognized.

2007060902 Glacier Point Staircase Falls RF Spring 6/9/2007 small

According to Park Geologist Greg Stock: A rock fall occurred behind Curry Village from the same source area as the 26 December 2003 Staircase Falls rock fall [see ID 2003122601]. The 9 June 2007 event consisted of failure of a single 18 m³ block that fell from the middle portion of the previously active source area. The block fell onto the large ledge of the Ledge Trail, swept off additional debris perched on the ledge from the 2003 event, and fell onto a large area of the talus slope near the base of Staircase Falls. No boulders extended beyond the talus slope, but flyrock extended to the southwestern edge of Curry Village and damaged hard-sided cabin unit 72B (broken window and hole in the rock-and-mortar foundation); there were no injuries. This area of Curry Village was evacuated pending assessment. Subsequent inspection of the backside of the rock fin separating the source area and the Staircase Creek channel showed the rock mass to be moderately to highly weathered and containing numerous joint sets and tension cracks. The overhanging block that failed was captured in before and after photographs (Wieczorek et al., 2008). This block was bounded on all sides by fractures and roots from a conifer tree that fell in 2003 but remained in the crack behind the block, likely contributing to the failure. Observation at approximately 13:00 PST on 9 June 2007 showed the detachment surface to be dry, although water from Staircase Creek was observed seeping out of joints several meters below the failed block. This event occurred during mild late spring weather, with no recent precipitation. A specific triggering mechanism was not recognized.

2007060903 Three Brothers Middle Brother RF Spring 6/9/2007 extremely small

According to George Ridgley (written commun. 26 June 2007): Ridgley was climbing the route "Absolutely Free" on Lower Brother when he heard and then saw two "bowling ball"-sized rocks falling down the face of Middle Brother on the east side of the large light-colored area between Lower Brother and Rixon's Pinnacle (below the 10 March 1987 rock-fall source area). Ridgley states: "While waiting my turn to climb the second pitch, I heard the sound of a rock fall - a 'crack' sound of rock striking rock. Instinctively looking up, I saw nothing and then relaxed. After a few moments, I heard another 'crack' and saw off to the right (where I happened to be looking) two rocks which appeared to be about the size and shape of bowling balls falling down the face. They were accompanied by several smaller rocks. Given the time between the initial and subsequent sounds of the rock fall, I conclude the rocks came from high on the wall, near the top.." The volume was less than 0.5 m³ and possibly consisted of debris that dislodged from the ledge below the 10 March 1987 failure. No trigger was recognized.

2007061901 Hetch Hetchy Hetch Hetchy Road RF Spring 6/19/2007 very small

According to Hetch Hetchy Law Enforcement Ranger Chris Smith (written commun., 21 June 2006): Smith reported a rock fall on the Hetch Hetchy Road about 0.1 mile east of the Smith Meadow trailhead. The road was closed for a few hours on 20 June 2007 while the debris was cleared. According to Smith, the event was likely triggered by a tree failure, with the uprooted root ball dislodging 4-5 rocks "too large to move by hand" fell about 10 m and landed on the road.

2007062401 Glacier Point Curry Village RF Summer 6/24/2007 extremely small

According to Park Geologist Greg Stock: A single rock (approximately 0.2 m³) fell from the Glacier Point cliff above the Tressider cabin in Curry Village, bounced down the talus east of the Ledge Trail, struck

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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the back door of the cabin, and knocked it down. A concessionaire employee and resident of the cabin was in the cabin at the time and took photos of the damage.

2007070601 Merced River Gorge Big Oak Flat Road RS Summer 7/6/2007 extremely small

According to Park Geologist Greg Stock: Rocks fell onto the westbound lane of Big Oak Flat Road between the middle and upper (long) tunnels. According to Park Dispatch, two "approximately 80 pound" rocks were on the road and were cleared within 30 minutes. The volume was approximately 0.2 m³.

2007070901 Merced River Gorge El Portal Road / Arch Rock RS Summer 7/9/2007 extremely small

According to Park Geologist Greg Stock: A "basketball-sized" rock was reported on El Portal Road west of the Arch Rock entrance station; the road was quickly cleared. The volume was approximately 0.2 m³.

2007071001 Giant Staircase Mist Trail RF Summer 7/10/2007 extremely small

According to Marea Ortiz, National Park Service Interpretation Ranger (written commun., 10 July 2007): An interpretive ranger was hiking down the Mist Trail and reported that "golf ball and tennis ball size rocks were falling and whizzing past her at eye to chest level [she was not injured]... The location was between the [Vernal Falls] footbridge and the start of the stairs [leading to the top of Vernal Falls]." The volume was less than 0.1 m³.

2007071501 Cathedral Range Bernice Lake RS Summer 7/15/2007 small

According to Chuck Carter, National Park Service Backcountry Ranger (written commun., 18 July 2007): Carter heard a rock slide at Bernice Lake near Vogelsang. He awoke to rumbling sounds and saw a long "trail of sparks" coming from the south wall above the lake and extending down the talus to the edge of the lake, but not reaching the lake. The volume was unknown but likely greater than 10 m³. No trigger was recognized.

2007071601 Half Dome Northwest Face RF Summer 7/16/2007 small

According to Tad Hunt (written commun., 23 July 2007): Climbers Tad Hunt, Derek Lee, and Patty Phan were climbing the "Regular Route" of the Northwest Face of Half Dome and reported several rock falls from the face. They described the rocks as coming down from the face west of them, likely from or near the 27 July 2006 source area (see ID 2006072702). The volume of the first rock fall was likely less than 10 m³.

2007071602 Half Dome Northwest Face RF Summer 7/16/2007 small

According to Tad Hunt (written commun., 23 July 2007): The same climbers [see ID 2007071601] reported a "large" rock fall occurring from the Northwest Face of Half Dome around 22:00 PDT, and described the initial impact at the base of the cliff sounding like "tons of rock". Rock fall sounds lasted about 30 seconds and indicate that the debris tumbled down the approach slabs to the talus slope. The volume of this rock fall was approximately 20 m³.

2007071701 Half Dome Northwest Face RF Summer 7/17/2007 very small

According to Tad Hunt (written commun., 23 July 2007): An additional rock fall from the Northwest Face of Half Dome was reported by the climbers in the very late pm of 17 July 2007 from roughly the same location as the rock falls the previous day [see ID 2007071601;]. This event was smaller, approximately 2-5 m³. No fresh rock debris was found on the Mirror Lake Loop Trail, indicating that the rocks stayed on the talus slope below the approach slabs. The triggers for all three rock falls are unrecognized.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2007072601 Glacier Point Staircase Falls RF Summer 7/26/2007 small

According to Valley Law Enforcement Ranger Brendan Bonner (oral commun., 26 July 2007): A rock fall occurred from the December 2003 Staircase Falls detachment area on Glacier Point. A block ~8 m³ in volume detached from the source area and landed on the "Ledge Trail" ledge immediately below, producing a small dust cloud. Most of the rock debris apparently stayed on the ledge, adding to the total volume of debris there, but a few small (<1 m³) boulders did impact the talus slope at the base of the cliff. No debris extended beyond the base of the talus. The weather was clear and dry, and the source area was dry. No trigger was recognized, although destabilization due to stress redistribution following the 9 June 2007 rock fall may have played a role.

2007083001 Glacier Point Happy Isles RF Summer 8/30/2007 small

According to Park Geologist Greg Stock: A small rock fall was reported from Glacier Point above Happy Isles. The volume was less than 10 m³, and precipitation was the probable trigger.

2007083002 Union Point Chapel Wall RF Summer 8/30/2007 small

According to Park Geologist Greg Stock: A rock fall was reported from the Chapel Wall south of the Chapel. The witness heard and then saw 1-2 boulders greater than 1 m³ in volume (cumulative volume less than 5 m³) slide down the slope above the cliff above the talus slope and then free fall over the cliff. The rocks struck the talus did not reach the base of the talus slope. The rock fall occurred during a rain storm, suggesting precipitation as a possible trigger; however, thermal stresses are also possible.

2007092301 Half Dome Northwest Face RF Fall 9/23/2007 small

According to Park Geologist Greg Stock: A series of rock falls were reported from Half Dome, described by a DNC employee as being "left of Snake Dike" as viewed from near Yosemite Lodge. Other witnesses thought the event originated from more toward the northwest face. The largest rock fall at about 10:20 PDT generated a small dust cloud. Smaller rock falls occurred from the same approximate location about one hour later. Spotting scope observation from Cook's Meadow did not reveal an obvious source area on the southwest face ("left of Snake Dike"), and a visit to the base of Snake Dike on 28 September 2007 did not show any fresh talus along the base of the southwest face. The exact source area was not determined, but was likely on the western side of the northwest face. The event followed about 2 days of rain and cool temperatures of the first post-summer storm. Precipitation and/or thermal stresses could be the trigger.

2007101701 Rockslides Rockslides RF/DS Fall 10/17/2007 small

According to Park Geologist Greg Stock: A rock fall and subsequent debris slide occurred from The Rockslides area west of El Capitan, and was witnessed from Bridalveil Meadow. The initial failure was approximately 3 m³ and originated on the steep cliffs near the Valley rim. As the debris moved down the talus slope, it dislodged additional debris from prior rock falls, creating a small debris slide with a cumulative volume of approximately 10 m³. The debris appeared to move to the base of the talus and the Valley floor. The event was preceded by slight rain and precipitation is a possible trigger.

2007121801 Three Brothers Middle Brother RF Fall 12/18/2007 small

According to Park Geologist Greg Stock: A small to medium-sized rock fall occurred from Middle Brother. One boulder, approximately 2 x 2 x 1.5 m (6 m³), landed on the northern lane of Northside Drive and several smaller fragments totaling less than 0.5 m³ were scattered nearby. Assessment from Leidig Meadow and Michael's Ledge suggested that the source area was within the March 2000 rock fall scar (the western of the two Middle Brother rock-fall sources from 2000). Evidence included fresh streaks on the cliff below the source area and a large Ponderosa Pine on the talus slope below the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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source area freshly broken mid-way up. The rock fall occurred during a winter storm with 4.42 cm of precipitation on 18 December 2007 (rain turning to snow). Precipitation and/or freeze thaw are considered probable triggers.

2007121802 Three Brothers Middle Brother RF Fall 12/18/2007 small

According to Park Geologist Greg Stock: Additional rock fall sounds from Middle Brother after dark were reported by YOSAR staff members staying in Camp 4. The volume was unknown, but likely less than 10 m³.

2007121901 Three Brothers Middle Brother RF Fall 12/19/2007 small

According to YOSAR member David Pope (written commun., 20 December 2007): Pope observed a rock fall from Middle Brother from his position at Sentinel Beach. Pope estimated the volume to be about 8 m³. Falling rock sounds lasted about 10 seconds. Pope did not directly observe detachment from the source area, but did see rock debris falling beneath the scar resulting from the 22 February 2000 rock fall west of Camp 4. Thus, this rock fall appears to be distinct from the nearby rock fall that occurred on 18 December 2007. Pope described the volume of the rock fall "to be approximately equal to the volume of a large garbage dumpster [about 8 m³]. The fall with its associated sound lasted about 10 seconds."

2007122501 Three Brothers Middle Brother RF Winter 12/25/2007 small

According to Park Geologist Greg Stock: Additional rock fall sounds from Middle Brother after dark were reported by YOSAR staff members staying in Camp 4. The volume was unknown, but likely less than 10 m³.

2008010401 Three Brothers Middle Brother RF Winter 1/4/2008 small

According to Valley District Ranger Leslie Reynolds (written commun., 6 January 2008): "On Friday, January 4th at approximately 19:00 hours a large "sounding" rock fall occurred within the closed area on Northside Drive." [A specific source area was not determined.]

2008010801 Three Brothers Middle Brother RF Winter 1/8/2008 small

According to Park Geologist Greg Stock: Stock witnessed a rock fall from Middle Brother while monitoring the cliff for rock-fall activity from a position in Leidig Meadow near Swinging Bridge. The rock fall originated from within the scar of the 1 March 2000 rock fall [ID 2000030101], in the upper part of the source area within a zone of sheared and weathered rock. Small rock fragments hit the talus slope beneath Middle Bother and extended to the edge of Northside Drive, but no fragments were reported on the road itself. The temperature was cold, below freezing, and there was light snow following a day of melt, suggesting freeze-thaw as a possible trigger.

2008011001 Merced River Gorge El Portal Road/Windy Point RF Winter 1/10/2008 very small

According to Park Geologist Greg Stock: A rock fall occurred from the road cut on El Portal Road at Windy Point from the same source area as the 5 March 2006 event. A volume of 3 m³ of rock extended across both lanes of the road. Heavy rain [2.74 cm on 8 January and 0.2 cm on 10 January 2008] was considered to be the most probable trigger.

2008011002 Merced River Gorge Big Oak Flat Road / Rattlesnake RF Winter 1/10/2008 small

According to Park Geologist Greg Stock: A single rock that fell onto Big Oak Flat Road just west of Rattlesnake Creek. The rock originated from the roadcut approximately 10-15 m above the road surface, along steeply dipping discontinuities oriented roughly sub-parallel to the roadcut face. The bedrock was moderately weathered, densely fractured, and consisted of diorite with some aplite. There

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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were numerous roots on the cliff face and root mats in the talus blocks on the road. The weather conditions were light freezing rain and snow, suggesting precipitation and/or freeze-thaw as the most likely triggers.

2008011601 Yosemite Falls Forbidden Wall RF Winter 1/16/2008 small

According to Park Geologist Greg Stock: A rock fall was reported north of the lower National Park Service housing area near Lower Yosemite Falls, in the vicinity of Upper Yosemite Falls or the Forbidden Wall. The fall was not observed because it was dark, but rock fall sounds were heard echoing off the Forbidden Wall.

2008011602 Yosemite Falls Forbidden Wall RF Winter 1/16/2008 small

According to Yosemite Institute instructor Kevin Sullivan (written commun., 21 January 2008): A small rock fall occurred west of Lower Yosemite Falls, originating either just above the "Five Open Books" climbing area or from the Forbidden Wall above the middle portion of the Yosemite Falls Trail. Sullivan did not see rocks falling but clearly heard them and observed a small dust cloud west of Lower Yosemite Falls.

2008012701 Yosemite Falls Forbidden Wall RF Winter 1/27/2008 small

According to Park Geologist Greg Stock: Stock heard a small rock fall from Yosemite Village, which sounded like it originated either near Middle Brother or the Forbidden Wall area above the Yosemite Falls Trail. The walls were obscured by low clouds so an exact source area could not be determined. The fall was preceded by 12 hours of sustained rain [6.32 cm on 27 January 2008] with near to below freezing temperatures, suggesting precipitation and/or freeze-thaw as probable triggers.

2008020301 Merced River Gorge Reed's Pinnacle RS Winter 2/3/2008 very small

According to Park Geologist Greg Stock: A rock slide occurred from the road cut on the northeast side of Big Oak Flat Road opposite the turnout for climber parking at Reed's Pinnacle. A block 2-3 m³ in volume detached from regolith in the road cut about 5 meters above the westbound lane and slid onto the road. There was very heavy snow at the time of detachment, and the colluvium in the road cut was saturated; precipitation was the likely trigger.

2008022001 Yosemite Falls n/a RF Winter 2/20/2008 small

According to Park Geologist Greg Stock: A climber camping at Camp 4 reported a possible rock fall near Yosemite Falls, but the source area was not identifiable because it was dark. The event was preceded by minor rain; precipitation was a possible trigger.

2008022201 Union Point Chapel Wall RF Winter 2/22/2008 small

According to Park Geologist Greg Stock: A rock fall was reported from an unidentified source area between the Chapel Wall and LeConte Gully. The event was heard from the Yosemite Valley School with rock fall sounds lasting 30-45 seconds, but was not seen due to heavy snow. The rock fall was preceded by approximately 36 hours of rain and snow (0.58 cm on 20 February, 0.86 cm on 21 February, and 3.22 cm on 22 February 2008). Precipitation is considered to be the most probable trigger.

2008022501 Sentinel Rock Sentinel Rock SA Winter 2/25/2008 small

According to Emily Jacobs (written commun., 26 February 2008): Jacobs observed snow and rock avalanches from a turnout on Southside Drive west of Sentinel Rock. The slides originated from the cliffs west of Sentinel Rock. One slide occurred at 17:25 and the second at 17:30, and both were apparently triggered by snow avalanches that subsequently entrained rock debris. Snow made up at least half of the total volume and although the rock volume was unknown, the cumulative volume of

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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rock debris was probably less than 20 m³. Snow avalanches were common on this date following two days of wet snow accumulation.

2008022801 Glacier Point LeConte Gully RF Winter 2/28/2008 small

According to Park Geologist Greg Stock: A rock fall was clearly heard in Curry and Yosemite Villages, and the subsequent investigation at sunrise revealed dust and rock debris on the snow in lower LeConte Gully, below the junction with the Ledge Trail. The rock fall originated from the cliff forming the west wall of LeConte Gully, slid down a short bedrock chute, and then free-fell over 100 m into LeConte Gully with some debris then sliding on snow down the gully. Scope observation indicates that an approximately 7 x 3 x 2 m vertically-oriented slab failed along a J1 sheeting joint. The detachment surface was wet at approximately 08:00 on 28 February and was still wet when observed at 08:00 on 1 March 2008. The rock fall occurred during a period of warm clear weather following a winter storm. Subfreezing night time temperatures following warmer temperatures suggested snowmelt and/or freeze-thaw triggers.

2008031301 Cathedral Rocks Gunsight RF Winter 3/13/2008 medium

According to Park Geologist Greg Stock: A rock fall was reported between Lower and Middle Cathedral Rocks, probably in the vicinity of the Gunsight. The volume was unknown, though the event purportedly produced a large dust cloud. The weather was clear and cold. Frost cracking may have occurred, but an exact trigger was not recognized.

2008040401 Glacier Point LeConte Gully RF Spring 4/4/2008 small

According to Park Geologist Greg Stock: A rock fall was reported in LeConte Gully by witnesses in Curry Village. The source area was possibly the same as the 28 February 2008 event. Debris fell into and moved down LeConte Gully, but no debris reached the talus slope. Temperatures during the event were warm, and snowmelt was a possible trigger.

2008041001 Three Brothers Middle Brother RF Spring 4/10/2008 small

According to Valley District Ranger Leslie Reynolds (written commun., 10 April 2008): "Last night at approximately 23:34 hours a rock fall was reported west of Camp 4 near Rixon's [Pinnacle on Middle Brother]. The reporting party said it lasted for 1 minute."

2008041901 Glacier Point Glacier Point Apron RF Spring 4/19/2008 small

According to Park Geologist Greg Stock: A rock fall occurred from the Glacier Point Apron. A bystander heard a double "boom" sound followed by about 5 seconds of rumbling. The exact source location was not seen, but the dust cloud was observed. Observation indicates that the source area was relatively low on the Apron, southwest of the wilderness use parking lot. The source area was approximately 2 x 2 m in size and climber's right (northwest) of the route "Harry Daley" on Monday Morning Slab. The weather was partly cloudy and approximately 60 degrees Fahrenheit. Snowmelt was a possible trigger, and there was abundant water seepage from Glacier Point.

2008042901 Yosemite Falls Yosemite Falls Trail RF Spring 4/29/2008 small

According to Park Geologist Greg Stock: Two park visitors witnessed a rock fall while hiking on the Yosemite Falls Trail in the upper gully. They heard a loud "pop" and then saw rocks falling. Investigation of 30 April 2008 failed to reveal any fresh rocks on the trail or an obvious source area; however, the November 1980 rock fall source area was a likely point of origin. The volume was unknown but estimated to be less than 10 m³ based on description and lack of debris on the trail. The trigger was unrecognized.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2008050101 Glacier Point Glacier Point RF Spring 5/1/2008 small

According to Park Geologist Greg Stock: A rock fall occurred from the ridge projecting north from the top of Glacier Point, west of the face below the viewpoint and just east of upper LeConte Gully. Visitors at Curry Village heard the event, and two parties observed rocks impacting the cliff face. Hard-sided cabins south and east of the Pavilion were temporarily evacuated. The rock fall was captured by video from the Ahwahnee Hotel, and helped to identify the approximate source area. Subsequent investigation from the concessionaire stables revealed the source area to be on a short vertical headwall on the east side of the ridge, above a brushy low-angle slope. A relatively thin slab failed along a J1 joint on the headwall, rolled and slid down the brushy slope to the cliff face, and fell down the face, fragmenting upon ledge impacts. Rock debris fell onto the talus slope but not beyond it. Spotting scope observation revealed a water streak on the freshly exposed detachment surface. Icicles had also formed on the shaded north facing cliff adjacent to the source area. The presence of sub-freezing nighttime temperatures and liquid water on the source area suggest a freeze-thaw trigger.

2008052701 Union Point Four Mile Trail RF Spring 5/27/2008 small

According to Park Geologist Greg Stock: A rock fall occurred from the cliff headwall above the Four Mile Trail, above and east of the long traverse beneath Sentinel Rock. The fall initiated near the top of the headwall and fell approximately 100 m onto the Four Mile Trail, covering the trail with rocks and broken vegetation (oaks). One hiker on the trail jumped out of the way of falling rocks, fell over a short cliff, and severely broke his leg. The detachment surface was wet with streaks of water and followed 3 days of light but persistent rain with above freezing temperatures. Numerous fir roots were exposed on the detachment surface from a tree adjacent to the source area. Precipitation and/or root wedging were possible triggers. The source area surface was moderately weathered, but little loose rock remained. However, a rectangular block approximately 4 m³ in volume remained above the source area, supported by a one cubic meter keystone block. Both blocks are detached from the cliff surface by a sheeting joint.

2008053101 El Capitan East Buttress RF Spring 5/31/2008 small

According to Park Geologist Greg Stock: A rock fall was reported west of the El Capitan picnic area. A witness heard the rock fall but could not precisely identify the location in the dark. Based on the description the source area was on or near the East Buttress of El Capitan, but subsequent investigation did not reveal a fresh rock scar. The trigger was unrecognized.

2008060301 Giant Staircase Liberty Cap RF Spring 6/3/2008 extremely small

According to Park Geologist Greg Stock: A small rock fall was reported on the trail by Nevada Fall on the switchbacks about 75 m down the trail from the bathrooms near the top of the fall. There was 0.2 m³ of rock debris on the trail, as well as some crushed vegetation. The exact source area was unidentified, and the weather was clear and warm. The trigger was unrecognized.

2008070701 El Capitan Southeast Face RF Summer 7/7/2008 small

According to Park Geologist Greg Stock: Numerous visitors reported a rock fall from the southeast face of El Capitan, just east of the Footstool below the North America Wall. The source area was within the scar of the 1970s era rock fall [ID 1976000001], with the failure occurring from the long, roughly horizontal roof extending over the scar. This roof failed along a surface parallel sheeting joint, which are numerous at this location. Witnesses in El Capitan Meadow heard thunderous crashing for about 30 seconds and saw a large dust cloud at the base of the wall. Numerous oak trees on the talus below the source area were obliterated by the fresh rock debris. The weather was clear, sunny (sunset), and very warm (approximately 85 degrees Fahrenheit). In the absence of other recognizable triggers, thermal stress is considered to be the most likely trigger for this rock fall.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2008070801 Tenaya Canyon Mount Watkins RF Summer 7/8/2008 small

According to Jesse McGahey, National Park Service climbing ranger (oral commun., July 2008): A rock fall occurred from the cliff between Snow Creek and Watkins Pinnacles, above Tenaya Creek. McGahey, on the northwest face of Half Dome, saw dust from the rock fall but could not identify the exact source area. The weather was warm with a building thunderstorm, but no measurable precipitation. The trigger was unrecognized.

2008070802 Basket Dome Basket Dome RF Summer 7/8/2008 small

According to Jesse McGahey, National Park Service climbing ranger (oral commun., July 2008): A rock fall occurred from the cliff below (south) of Basket Dome and above Mirror Lake. McGahey, on the northwest face of Half Dome, heard a thunderous booming sound and saw the rocks falling and dust cloud forming over Basket Dome. The source area was on the upper western portion of the cliff, approximately 200-300 m above the base, within or very near the spring 1996 Basket Dome rock-fall source area [ID 1996010001]. McGahey reported a single rock that fell for approximately 10-20 seconds. The weather was warm with light rain associated with an afternoon thunderstorm. The trigger was unrecognized.

2008080501 Hetch Hetchy Beehive Switchbacks RS Summer 8/5/2008 very small

According to Jim Snyder (written communication, 27 January 2011): "On the morning of August 5, 2008, packer Wayne Erickson was leading a small pack group into the backcountry above Hetch Hetchy via the old Hetchy-Eleanor Road switchbacks (also known as the Beehive Switchbacks). Between the fourth and fifth switchback going up, in a narrow section of trail, a rock came down from the hillslope above the trail and hit Erickson's horse in the hindquarters, breaking a leg and possibly causing additional injuries. Erickson was pinned for a few minutes by the injured horse but managed to escape unharmed. Other stock animals and riders were uninjured. Jay Barnes from the Mather Pack Station was summoned and determined that the horse was unlikely to survive its injuries, so it was euthanized in place by Hetch Hetchy rangers and moved away from the trail."

2008081301 North Dome/Washington Column Washington Column RF Summer 8/13/2008 small

According to Park Geologist Greg Stock: Numerous visitors reported a rock fall from just west of Washington Column, between the west side of the column and the east side of Royal Arches, in or near the steep, narrow joint-controlled gully separating the two. Campers in the Backpacker's Campground reported about 10 seconds of rock fall sounds and described hearing multiple rock impacts. One observer witnessed rocks falling and bouncing near the base of the gully. Rock debris did reach the talus slope below the gully but did not extend beyond it onto the Valley Loop Trail. The weather was clear, with no recent precipitation, and cool temperatures in the morning (still above freezing) but otherwise a period of warm temperatures in Yosemite Valley (>90 degrees Fahrenheit). No specific trigger was recognized, but the failure may be related to thermal stresses.

2008081901 Merced River Gorge Big Oak Flat Road RS Summer 8/19/2008 very small

According to Park Geologist Greg Stock: A small rock slide occurred on Big Oak Flat Road from a road cut on the northeast side of the road approximately 1.5 miles northwest of the Foresta turnoff. Rocks on the road were quickly cleared. The trigger was unrecognized.

2008082601 Tenaya Canyon Quarter Domes RF Summer 8/26/2008 small

According to Park Geologist Greg Stock: A rock fall occurred from the cliff directly across Tenaya Canyon from Snow Creek, between Half Dome and Quarter Dome. The rock fall lasted about 4 seconds and produced a small dust cloud. The failure consisted of a relatively thin (~1 m thick) slab within a stepped

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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portion of the cliff dominated by sheeting joints. The weather was clear and warm with no precipitation; a specific trigger was not recognized, but failure may have been related to thermal stresses.

2008092001 El Capitan Southeast Face RF Summer 9/20/2008 very small

According to Park Geologist Greg Stock: Climbers on El Capitan report a small rock fall from the southeast face of El Capitan, most likely from the same location as the 7 July 2008 rock fall [ID 2008070701] that occurred from an area of dense sheeting above and east of the Footstool.

2008092201 Yosemite Falls Forbidden Wall RF Summer 9/22/2008 small

According to Park Geologist Greg Stock: A rock fall originating from the cliffs above the Yosemite Falls Trail (the "Forbidden Wall") was reported by numerous parties. Witnesses describe seeing several rocks falling and producing a small dust cloud. Spotting scope observation revealed the source area to be above the relatively level section of trail separating the lower and upper switchbacks, roughly even in elevation with the base of the upper falls; approximately 200 m above the trail. Minimal fresh rock debris was found on the trail and it was reopened. The weather was cool and clear. The trigger was unrecognized but freeze-thaw was a possibility.

2008100101 North Dome/Washington Column North Dome RF Fall 10/1/2008 small

According to Doug Brown (written commun., 12 October 2008): Brown hiked to the top of Half Dome on 1 October and, as they descended down the cables they heard "'thunder' to the north. We realized that instead it was a rock slide just east of North Dome along the north side of [Tenaya Canyon] above Mirror Lake."

2008100701 Glacier Point Ledge Trail RF Fall 10/7/2008 large

According to Park Geologist Greg Stock: A large rock fall occurred from above the Ledge Trail on Glacier Point, about 200 m above the east-dipping joint-controlled ledge of the Ledge Trail, adjacent to (immediately east of) detachment surfaces formed by rock falls in August and September 2001 [see IDs 2001091401, 2001091402, 2001092502]. The failed rock mass was an approximately 2 m thick slab that was roughly oval-shaped in perimeter. Rock debris impacted the Ledge Trail ledge and moved downward to the east, onto the top of the talus slope at the base of the ledge. Numerous large Douglas Firs were snapped or toppled by boulders moving down the talus slope below the Ledge Trail. Rock debris traveled down the east side of the talus slope and into the southeastern part of Curry Village in the vicinity of the Foster Curry Cabin. One unoccupied tent cabin just east of the Foster Curry Cabin was severely damaged by a 1 m³ boulder, and another was struck by a small flyrock (4 cm diameter) fragment. These tent cabins were unoccupied at the time. No boulders extended beyond the base of the talus slope but several boulders up to 3-4 m³ came to rest within approximately 50 m of the mapped edge of the talus. (2) From Stock et al. (2011): Repeat photography and laser scanning of the cliff before and after the rock falls revealed that the "cumulative rock fall volume [7 and 8 October events] is 5,663 ± 36 m³... Photographs of the source area taken immediately after the 7 October rock fall suggest that of this total cumulative volume, ~20% (~1,133 m³) is attributable to the [7 October] event..." (3) According to Noreen Trombley, National Park Service (oral commun., November 2008): A volunteer work crew supervised by National Park Service staff was working at Lower Pines campground on 7 October 2008 and reported hearing at least two sharp cracking sounds (described as sounding like gunfire) from the cliff below Glacier Point several hours prior to the rock fall. (4) According to a post by "Lightgirl" on the Supertopo Forum (written commun., 8 October 2008): "I was working in Lower Pines yesterday [7 October 2008] morning when I thought I heard fire crackers. I didn't see anyone with them, but it went on randomly for maybe twenty minutes or so. The two rangers I was working with

didn't recognize the sound either. One or two sounded more like gun shots. About an hour later I heard the first small rock fall. Ten or so minutes later it sounded like a very small rock fall. It wasn't until a couple hours later that that the big one started above the Ledge Trail." [Although the exact source of the cracking sounds cannot be confirmed, it is likely that these sounds emanated from the 7 October (and/or 8 October) 2008 rock-fall source area on Glacier Point, suggesting that crack propagation was occurring along the sheeting joint(s) that eventually became the detachment surfaces for the rock falls.]

2008100801 Glacier Point Ledge Trail RF Fall 10/8/2008 large

(1) According to Park Geologist Greg Stock: A second, larger rock fall occurred from above the Ledge Trail at Glacier Point on 8 October 2008, from the same location as the rock fall of the previous day [see ID 2008100701]. As with the previous event, the failed rock mass detached from a steeply inclined northeast facing sheeting (exfoliation) joint surface parallel to the cliff face, and free fell approximately 220 m, impacting the east-dipping ledge of the Ledge Trail and fragmenting into numerous boulders and smaller debris. Both the 7 and 8 October rock fall runout paths were strongly influenced by the Ledge Trail ledge, but unlike debris from the 7 October rock fall, which primarily impacted the far eastern side of the talus slope below this ledge, rock debris from the 8 October rock fall went primarily straight down this talus slope along the path of the seasonally active stream channel, fanning out as it moved down the slope but primarily impacting the central part of Curry Village south of the Pavilion and Amphitheater. Large Douglas Firs and cedar trees were snapped and toppled by boulders as they bounced and rolled down the talus slope. The largest boulder, which came to rest within the gully on the central part of the talus slope, upslope of tent cabins in the central part of Curry Village, was approximately 150 m³ in volume. One boulder approximately 3 m in diameter rolled over three unoccupied tent cabins just east of here and came to rest essentially on a hard-sided cabin that had been vacated roughly 20 minutes earlier. Several other hard-sided cabins in the immediate vicinity sustained damage from impacts of flyrock and larger particles (up to 80 cm), including punctured walls and broken windows. Overall at least 25 tent and hard-sided cabins sustained some kind of impact, and 3 hard-sided cabins were totally destroyed. Some of these cabins were occupied at the time of the rock fall but the occupants escaped major injury. Three minor injuries were associated with the rock fall; one child received a cut on his forehead from a rock fragment, one woman was injured while fleeing the scene, and one person sustained an asthma attack as a result of the incident. Several boulders also impacted the base of the talus slope farther to west, directly beneath Staircase Falls; photographs of the rock fall occurring, taken by National Park Service employee Brad Benter from the northwest face of Half Dome, show some rock debris taking a direct path over the ledges that create Staircase Falls, rather than being diverted eastward by the Ledge Trail ledge as most of the debris was. The boulders that went straight over the ledge landed within 20 m of hard-sided cabins below Staircase Falls but did not cause any damage [these cabins were permanently closed in June 2008 due to rock fall hazards from the Staircase Falls area and were not occupied at the time of the 8 October rock fall]. (2) From San Francisco Chronicle (2008): "A large slab of granite cracked loose from a cliff in Yosemite National Park early Wednesday and crashed into the Curry Village resort with a thunderous roar, flattening tents and forcing hundreds of campers to run for their lives. Dozens of schoolchildren fled the scene screaming and crying as broken rock rained down, snapping trees, smashing through the walls of cabins and sending a plume of dust hundreds of feet in the air. 'It sounded enormous, like the earthquakes I've been in in Los Angeles' said Tom Voelpel, a lighting technician from Valencia who was sharing a tent at Curry Village with his twin brother, Dave, in celebration of their 50th birthday. 'You could hear trees snapping and rock crunching and cracking against each other.' The brother jumped behind the wooden wall of their cabin just as a boulder smashed through the wall, causing it to collapse on top of a nightstand. 'It was scary,' said Dave, an artist from Indianapolis who saw one bleeding boy amid the dozens of panic-stricken schoolchildren. 'I want to go home,' he said the boy screamed. 'I'm

bleeding!'... The place [Curry Village] erupted in pandemonium as hundreds of terrified campers rushed out in underwear and nightclothes amid a roar that several witnesses said sounded like thunder. Deanne Maschmeyer, 41, of Seaside (Monterey County) was sleeping next to her 14-year-old daughter and 12-year-old son when the slide began. At first they crouched down. Then her daughter, Alexis Mooneyham, screamed 'Run for your lives!' 'We literally bolted out of bed and started running,' Maschmeyer said. 'It was like the tsunami footage several years ago. We hurdled fences and sprinted through the meadow. It was a pure adrenaline rush. We were surrounded by kids crying and yelling.' The three of them found themselves in the parking lot in skimpy clothes. Maschmeyer's son, Connor Mooneyham, was wearing only boxer shorts. A Yosemite park worker gave him his coat. Strangers and park workers gave them clothes to wear.... All occupants of the more than 600 tent and wooden cabins and a small, hotel-style building at Curry Village were ordered out as a precaution, and trails in the area were closed, Yosemite officials said. In all, 1,005 people were evacuated. By nightfall, 100 to 150 had been allowed back in, but the rest were put up in motels and hotels surrounding the park, unable to retrieve their belongings..." (3) From Stock et al. (2011): Repeat photography and laser scanning of the cliff before and after the rock falls revealed that the "cumulative failure [7 and 8 October 2008 events] consisted of a near-planar, vertically-oriented rock slab with a maximum length of 69.0 m, a mean thickness of 2.1 m, a maximum thickness of 7.1 m a detachment surface area of 2750 m², and a volume of 5,663 ± 36 m³... Photographs of the source area taken immediately after the 7 October rock fall suggest that of this total cumulative volume, ~20% (~1,133 m³) is attributable to the [7 October] event and the remainder (~4,530 m³) attributable to the subsequent 8 October rock fall." (4) According to Park Geologist Greg Stock: Observation of the detachment surface from the ground immediately after the rock fall occurred did not reveal the presence of water, and close inspection of this surface from a helicopter approximately 45 minutes after the rock fall occurred likewise showed the surface to be dry. However, staining on the rock surface indicates that water was at least occasionally present behind the failed slab and may have helped to destabilize the slab (during spring runoff and immediately after storms, a water streak is visible directly across the detachment surface). The extent of staining suggested that much of the slab was previously detached from the rock behind it, with seven areas of attachment represented about 26% of the total detachment surface area. In addition, the bottom of the failed slab was a roof created by earlier rock falls in August and September 2001 [see IDs 2001091401, 2001091402, 2001092502]. These earlier rock falls likely also played a role in the progressive destabilization of the block. Despite these contributing factors, an exact trigger for the 8 October 2008 rock fall is not unrecognized. (5) Stock et al. (2011) performed structural analyses of the rock-fall detachment surface and surrounding area utilizing high-resolution digital photographs and ground-based laser scanning (LiDAR) data. Detachment occurred along a surface parallel sheeting joint oriented 027°/89° (dip direction/dip angle). Stock et al. (2011) suggest that shear (sliding) failure was the most likely failure mode, and may related to stress concentration at crack tips within the attached areas.

2008103101 Cathedral Rocks Middle Cathedral Rock RF Fall 10/31/2008 small

According to Park Geologist Greg Stock: A rock fall occurred from high on Middle Cathedral Rock, just west of and well above the climbing route "Central Pillar of the Frenzy". Photographs taken during the event by a park visitor in El Capitan Meadow show the rock-fall source area just west of the notch below the V-shaped basin at the top of the north face of Middle Cathedral Rock, below a tree-covered ledge. The detachment surface was roughly square, ~3 x 3 m, and comparison of repeat photographs suggest the failed slab was relatively thin, ~1 m. The detachment surface was a distinct orange color, suggesting advanced weathering of the bedrock there. A brown streak emanated from the source area down the cliff, suggesting that at least some soil was mobilized, as well as rock. Impacts on the cliff near "Central Pillar of Frenzy" produced a small dust cloud. Much of the rock debris from the rock fall was deposited

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on the talus slope, but approximately 1 m³ of rock debris extended beyond and impacted Southside Drive where the edge of the talus slope is closest to the road; debris was distributed on the road over a length of approximately 60 m. Rain fell for about 24 hours prior to the rock fall (0.23 cm on 30 October and 2.34 cm on 31 October 2008) and it was lightly raining when the rock fall occurred; precipitation is considered to be the most probable trigger.

2008110101 Glacier Point Ledge Trail RF Fall 11/1/2008 small

According to Park Geologist Greg Stock: Multiple small rock falls were reported from Glacier Point behind Curry Village. Rock falls were reported at approximately 20:00 and 21:00 on 1 November 2008 and also at 04:15, 07:30, 08:00, and 09:00 on 2 November 2008. The events in the early morning were reported as "nearly continuous small rock falls". Dense cloud cover obscured the cliff face, but later observation of the 8 October 2008 rock fall source area did not reveal any obvious change; the rock falls were probably sourced from the abundant fresh debris on the Ledge Trail. One rock fall was possibly sourced from the Staircase Falls area. There was heavy rain (0.23 cm on 30 October, 2.34 cm on 31 October, 4.52 cm on 1 November, and 2.13 cm on 2 November) and above-freezing temperatures prior to the rock fall, suggesting precipitation as the most probable trigger; precipitation probably saturated finer-grained material upon which larger boulders rested, causing the boulders to slide and fall.

2008110102 Glacier Point Staircase Falls RF Fall 11/1/2008 See ID 2008110101

See ID 2008110101

2008110103 Cathedral Rocks Middle Cathedral Rock RF Fall 11/1/2008 small

According to Park Geologist Greg Stock: A rock fall was reported from Middle Cathedral Rock. A bystander heard the event from the river near Bridalveil View turnout and located the rock fall source area on the western face of Middle Cathedral Rock west of the climbing route "Central Pillar of Frenzy". There was heavy rain (0.2 cm on 30 October, 2.3 cm on 31 October, and 4.5 cm on 1 November 2008) and above-freezing temperatures prior to the rock fall, suggesting precipitation as the most likely trigger.

2008110201 Glacier Point Ledge Trail RF Fall 11/2/2008 See ID 2008110101

See ID 2008110101

2008110202 Merced River Gorge Big Oak Flat Road RF Fall 11/2/2008 very small

According to Park Geologist Greg Stock: Small rocks fell onto the Big Oak Flat Road between the eastern-most (lower) tunnel and the junction with El Portal Road. The exact source area was not determined but was reported as being above the road cut. There was heavy rain (0.23 cm on 30 October, 2.34 cm on 31 October, 4.52 cm on 1 November, and 2.13 cm on 2 November) and above-freezing temperatures prior to the rock fall, suggesting precipitation as the most probable trigger.

2008110203 Glacier Point Ledge Trail RF Fall 11/2/2008 See ID 2008110101

See ID 2008110101

2008110204 Glacier Point Ledge Trail RF Fall 11/2/2008 See ID 2008110101

See ID 2008110101

2008110205 Indian Canyon Castle Cliffs RF Fall 11/2/2008 small

According to Park Geologist Greg Stock: Stock heard approximately 20 seconds of rumbling from a rock fall from the Castle Cliffs north of the National Park Service stables, but the source area was not visible through the low clouds. Based on the rock-fall sounds, the volume of the rock fall is estimated to be

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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approximately 10 m³. The event occurred during steady rain, and there was substantial rain over the previous 48 hours. Precipitation was the most likely trigger.

2008110206 **Glacier Point** **Ledge Trail** **RF** **Fall** **11/2/2008** **See ID 2008110101**
See ID 2008110101

2008110401 **El Capitan** **Southwest Face** **RF** **Fall** **11/4/2008** **medium**

According to Park Geologist Greg Stock: A rock fall was reported from the west face of El Capitan, originating from roughly above the heart-shape alcove on the Salathe Wall. A witness saw several large blocks, each approximately 3 m on a side, free-falling along the face. Impacts on the lower wall and talus slope produced a small dust cloud. The weather was relatively clear, but followed several days of rain in the valley and snow on the summit of El Capitan. The trigger was probably precipitation and/or freeze-thaw. Reconnaissance along the base revealed fresh debris and damaged trees from climbing routes Sacherer Cracker to La Cosita Right.

2008120701 **Basket Dome** **Snow Creek Trail** **RS** **Fall** **12/7/2008** **small**

According to Park Geologist Greg Stock: A rock slide was reported on the Snow Creek Trail, approximately half way up the switchbacks from the floor of Tenaya Canyon. The debris consisted of two boulders, about 4 m³ in size, plus several smaller boulders for a total volume of approximately 10 m³. Failure occurred from the hillslope less than 10 m above the trail. The trigger was unknown, as the precise date and time of the failure were unknown, but it was probably related to snowmelt and/or freeze-thaw.

2009010301 **Giant Staircase** **Vernal Fall** **RF** **Winter** **1/3/2009** **medium**

According to Park Geologist Greg Stock: Hikers reported a rock fall from just southeast of Sierra Point and above the John Muir Trail, west of Vernal Fall. The hikers did not observe the rock fall, but encountered about 10 m³ of rock debris on the trail, as well as some trail damage as well as numerous downed oak trees. Subsequent investigation by Stock and National Park Service Trails foreman Dave Kari revealed the source area to be from the cliff face about 150 m above the top of the talus cone beneath the cliff. A slab approximately 11 x 7 x 1.5 m (based on laser rangefinder measurements of the source area), for a total volume of approximately 115 m³, slid down a steeply inclined (~70 degree) bedrock plane and then tumbled down the rest of the cliff, fragmenting on impact and sending boulders up to 1 m in diameter down the talus slope and onto and across the trail. The exact timing of the rock fall was not known; however, failure occurred during a period of snowmelt, rain, and freezing temperatures, suggesting that the most probable triggers were precipitation and/or freeze-thaw.

2009011601 **El Capitan** **Southeast Face** **RF** **Winter** **1/16/2009** **very small**

According to Park Geologist Greg Stock: Stock and GeoCorps Intern Robert Sas observed a small, single rock fall from midway up the southeast face of El Capitan, west of the East Buttress and east of the climbing route "Zodiac", near the path of Horsetail Falls. The weather was clear and relatively warm (upper 50s degrees Fahrenheit). The trigger was likely snowmelt associated with water from Horsetail Falls.

2009011701 **Three Brothers** **n/a** **RF** **Winter** **1/17/2009** **medium**

According to Karen Amstutz, National Park Service Interpretive Ranger (oral commun., January 2009): A rock fall occurred somewhere between the East Buttress of El Capitan and the Three Brothers. Amstutz was in El Capitan Meadow and heard a loud rock fall sound lasting tens of seconds. The source area was unknown, but no rock fall debris reached Northside Drive. Subsequent investigation near the base of the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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East Buttress and the El Capitan picnic area did not yield any fresh rock debris, suggesting the source area may have been up in the side canyon of Eagle Creek. The weather was clear and relatively warm, and the presence of snow suggest that the trigger may have been snowmelt.

2009012201 Glacier Point Ledge Trail RF Winter 1/22/2009 very small

According to Park Geologist Greg Stock: Two small rock falls were reported from Glacier Point behind Curry Village. One rock fall appeared to have originated at or near the 8 October 2008 Ledge Trail source area, about 1 m³ in volume. The other rock fall apparently originated at or near the 2003 and 2007 Staircase Falls source area, and was also approximately 1 m³. Both instances appeared to involve loose debris from earlier rock falls. Visibility was hampered by low clouds and heavy rain. Precipitation was the most probable trigger.

2009012202 Glacier Point Staircase Falls RF Winter 1/22/2009 very small

See ID 2009012201

2009012901 Royal Arches Rhombus Wall RF Winter 1/29/2009 medium

According to Park Geologist Greg Stock: A rock fall occurred from the upper portion of the Rhombus Wall north of the Ahwahnee Hotel and east of Serenity/Sons and Royal Arches. Just above and west of the climbing route "Superslide", approximately 290 m³ of rock detached from a southward slope J1 sheeting joint (source area was approximately 12 x 12 m) and fell about 400 m impacting the large talus slope north the Ahwahnee parking lot. Impact along the talus, and possibly along the fall path, produced a large dust cloud and numerous flyrock fragments. Rock debris destroyed trees on the talus slope but did not reach the Valley Loop Trail. Flyrock, however, extended to the trail and slightly beyond it into the paved parking lot. One vehicle in the parking lot sustained a broken windshield. No other damage or injuries were reported. Observation of the source area with a spotting scope revealed obvious seepage over the source area, emanating from a joint bounding the upper portion of the detachment surface. Many other adjacent areas on the cliff showed similar seepage. The weather was clear and warm (mid 50s degrees Fahrenheit) with snowmelt during the day and freezing at night. The trigger was likely snowmelt and/or freeze-thaw.

2009020501 Yosemite Falls Upper Yosemite Falls RF Winter 2/5/2009 very small

According to Park Geologist Greg Stock: A rock fall was reported from the Upper Yosemite Falls Trail area, possibly the Forbidden Wall. Park Dispatch was unable to confirm the report.

2009022201 Crocker Point Fifi Buttress RF Winter 2/22/2009 small

According to Ryan Leahy, National Park Service Bear Technician (oral commun., February 2009): A rock fall occurred west of Bridalveil Falls near Fifi Buttress. Leahy did not observe the rock fall due to low clouds, but heard about 15 seconds of rumbling. The reported sounds suggest a large rock fall, perhaps 40 m³. There was rain prior to and during the event (2.34 cm on 22 February 2009), suggesting a precipitation trigger.

2009022901 Merced River Gorge Pat & Jack's Pinnacle RF Winter 2-3/29-7/2009 small

According to Tim Martel (oral commun., March 2009): A rock fall from the cliff near Pat and Jack's Pinnacle west of Lower Cascade Falls. Martel did not witness the event, but encountered fresh rock debris at the base of the climbing route "The Tube". Subsequent investigation revealed rock debris covering an area 15 m downslope of the base of the climb. The total volume was 8 m³, and the source area was approximately 100 m above the top of the talus, midway up the cliff just above a large tree-

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covered ledge. There was an intense winter storm on 1-5 March 2009 (10.36 cm of rain fell during that time period). Precipitation and/or freeze-thaw are considered probable triggers.

2009030401 Yosemite Falls Yosemite Falls RF Winter 3/4/2009 small

According to Park Geologist Greg Stock: Stock heard a loud but short (6 seconds) rumble from Yosemite Village, perhaps originating near Yosemite Falls. The fall was associated with heavy rain turning to snow, so an exact source area could not be identified.

2009032601 Merced River Gorge El Portal Road/Windy Point RF Winter 3/26/2009 very small

According to National Park Service Roads and Trails chief Tim Ludington (written commun., 30 March 2009): A rock fall occurred from Windy Point, sending rocks onto the El Portal Road. The impact of the rocks onto the roadways caused minor damage at the fog line.

2009032701 Half Dome Ahwiyah Point RF Spring 3/27/2009 medium

(1) According to Park Geologist Greg Stock: Numerous reports from visitors staying in the Pines campgrounds of a loud rumbling sound from the vicinity of Mirror Lake; the sound was loud enough to wake many people sleeping in tents. Climbers sleeping on "Dinner Ledge" on Washington Column also heard the event and approximately located the source area near Half Dome. Several smaller rock falls occurred from the same area over the next several hours. Although an exact source area location was not determined, it is almost certain that these rock falls were smaller precursors to the very large rock mass that fell from Ahwiyah Point a few hours later [ID 2009032801]. Volume analyses are cumulative for all rock falls occurring during the period 28-29 March 2009, but based on the reported sounds the volume of this event was likely in the range of 200 m³. (2) From Zimmer et al. (2012): "According to eyewitness reports from rock climbers located across the valley from Ahwiyah Point, the series began with a large rock fall during the night, followed by several hours of punctuated smaller rock falls..."

2009032801 Half Dome Ahwiyah Point RF Spring 3/28/2009 very large

(1) According to Park Geologist Greg Stock: This was the largest in a series of rock falls from Ahwiyah Point, located above Mirror Lake on the south wall of Tenaya Canyon, approximately 800 m northeast of Half Dome. Repeat laser scanning revealed that this largest rock fall consisted of the failure of a block 50 m wide, 80 m tall, and 26 m thick (maximum dimensions), for a total volume of approximately 24,800 m³. This block slid approximately 300 meters down the northwest face of Ahwiyah Point, removing approximately 2,000 m³ of rock slabs and other projections from the face, before impacting a prominent bedrock ledge about 400 m above the floor of Tenaya Canyon. This impact dislodged an additional approximately 18,400 m³ of rock from the ledge, leaving a wedge-shaped void. (2) According to rock climber David Allfrey (written commun., 31 March 2009): Allfrey was bivouacked on Dinner Ledge midway up Washington Column and, having heard several smaller rock falls earlier in the night, sat up immediately when he heard the loud rumbling. In the dark, he observed the block sliding down the upper face as a long orange streak, as sparks were produced by rock-on-rock sliding and ledge impacts. "...at the pre-dawn hours I woke to a huge ... boom, jerked up, looked over to see the entire side of Ahwiyah Point shrouded in a massive dust cloud falling down, the lead end looked like a massive fireworks shows. When it slammed into the floor [of Tenaya Canyon], it crashed down into a huge plume of dust that went upwards and pushed out all the way across the valley floor". (3) According to Park Geologist Greg Stock: Acquisition of subsequent airborne and ground-based laser scanning data, and comparison with airborne laser scanning data obtained prior to the rock fall, indicate that a total of 46,700 m³ of rock mobilized during the event. The combined rock-fall debris (derived from the source area, smaller ledges, and from the mid-cliff impact point), traveled down the lower face and impacted

the floor of Tenaya Canyon, knocking down hundreds of trees and burying a portion of the Mirror Lake Loop Trail in rock debris to a depth of several meters. An air blast from the event leveled additional trees up to 30 m past the rock-fall deposition zone. The impact of the debris was detected by seismometers up to 400 km distant, registering as a magnitude 2.4 earthquake; this shaking was most likely as a result of the collision of the source area rock mass onto the lower ledge (<http://seismo.berkeley.edu/blogs/seismoblog/php/2009/03/30>). Because the rock fall occurred in a relatively remote location (Tenaya Canyon) before sunrise, there were no injuries or fatalities; however, the Mirror Lake loop trail was completely destroyed at this location. When the area was observed roughly three hours after the rock fall occurred, dust coated every surface in the Mirror Lake area and was floating on the lake surface. The thickest accumulations were directly across Tenaya Creek from the final impact point and were up to 1 cm thick in places. The detachment surface showed several prominent areas of seepage; recent warm temperatures with associated snowmelt, and a lack of recent precipitation, suggest that snowmelt was the most likely source of water. Although an exact trigger is not known with certainty, water in the form of snowmelt is considered the most likely trigger. (4) From Zimmer et al. (2012): "The total volume consists of 25,400 m³ from the rock-fall source area, 2,000 m³ from intermediate blocks dislodged as the rock fall traveled downwards along the upper cliff face, and 19,300 m³ from the mid-cliff impact of the rock fall on the lower promontory. A minor additional amount of rock (estimated to be less than 1,000 m³) was detached below this point and prior to final impact. Upon final impact at the base of the cliff, the rock fall remobilized an additional 7,000 m³ of existing accumulating talus, pushing the upper portion of the talus slope downward and outward. The average talus slope angle was reduced from 31° to 29°, the height of the talus at the apex was lowered by up to 13 m, and the toe was extended by 48 m horizontally for a 50 m distance parallel to the base... Cross-sections generated through the pre- and post-rock fall surfaces show that the source block consisted on an 80 m long, 50 m wide, 26 m thick block, measured at its maximum dimensions. Analysis of the point and surface data show that failure occurred along the intersection of four prominent intersecting planes (joints) consisting of an approximately 67° inclined, northwest-dipping surface (approximate dip/dip direction = 67°/322°) a 67° inclined, west-dipping surface (approximate dip/dip direction = 67°/272°), a 90° inclined, west-dipping surface (approximate dip/dip direction = 90°/236°), and a 46° inclined, west-dipping surface (approximate dip/dip direction = 46°/262°) which formed the bottom sliding surface of the rock fall... The source block was further bounded by several east-dipping roofs inclined at between 51° and 59° (average dip/dip direction = 56°/097°)... Analysis of the mid-cliff impact zone indicates that a wedge formed by two intersecting planes (joints) was dislodged by the impact of rock debris from above. The wedge is formed by the intersection of a 59° inclined, northwest-dipping surface (approximate dip/dip direction = 59°/319°) and a 58° inclined, southwest-dipping surface (approximate dip/dip direction = 58°/224°)..."

2009032802 Half Dome Ahwiyah Point RF Spring 3/28/2009 small

(1) According to Park Geologist Greg Stock: There were numerous reports of continuing small rock falls from the Ahwiyah Point rock-fall source area throughout the day on 28 March 2010. Several of these rock falls were substantial in volume (up to a few tens of m³) and produced small dust clouds. The largest rock fall observed by Stock was approximately 15 m³ in volume. Most of these rock falls appeared to consist of debris that was perched on ledges beneath the initial source area, but at least two rock falls appeared to have initiated from the initial source area. These secondary rock falls may have also been triggered by snowmelt, but their failure was almost certainly related to the initial larger failure through stress redistribution or gradual settling of rock debris. (2) From Zimmer et al. (2012): "Smaller rock falls continued for more than one month after [the largest event on 28 March 2009]."

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2009032901 Half Dome Ahwiyah Point RF Spring 3/29/2009 small

According to Park Geologist Greg Stock: Visitors in the Mirror Lake area reported an additional small rock fall from the Ahwiyah Point source area.

2009040201 Half Dome Ahwiyah Point RF Spring 4/2/2009 medium

According to Park Geologist Greg Stock: An additional medium-sized rock fall occurred from the Ahwiyah Point source area. Visitors in Yosemite Village heard a low rumbling sound. Numerous witnesses in the Mirror Lake area observed the event, describing a substantial dust cloud.

2009041801 Half Dome Ahwiyah Point RF Spring 4/18/2009 small

(1) According to Park Geologist Greg Stock: Stock heard a rumbling sound of a rock fall in Yosemite Village, and, suspecting a rock fall from Ahwiyah Point, confirmed with visitors in the Mirror Lake area that another rock fall had occurred from the vicinity of Ahwiyah Point. The rocks appeared to have fallen from the prominent bedrock ledge well below the source area (but above the floor of Tenaya Canyon) that was struck hard by the initial rock fall on 28 March 2009, rather than from the initial source area of that event. The rocks that fell may have been previously detached and lying on or just below the prominent ledge. (2) According to Tony Rousmaniere (written commun., 8 May 2009): Rousmaniere and his climbing partner Morri Feldman observed the rock fall from Dinner Ledge on Washington Column and described the rock fall lasting 15-30 seconds, creating a substantial dust cloud that lasted at least 20 minutes.

2009042401 Half Dome Northwest Face RF Spring 4/24/2009 small

According to Martin Heatlie (written commun., 24 April 2009): A rock fall occurred from the summit of the northwest face of Half Dome. Heatlie witnessed the event from Mirror Lake while scanning the northwest face for climbers. According to a sketch drawn by Heatlie, the failure occurred from an area of dense sheeting joints west of the "Visor", the prominent overhang at the summit. Heatlie described the volume as "a dozen refrigerator-sized rocks". No trigger was recognized.

2009042402 Cathedral Rocks Cathedral Gully RF Spring 4/24/2009 small

According to National Park Service Interpretive Ranger Karen Kanes (written commun., 28 April 2009): Kanes was at Devil's Elbow near El Capitan Meadow and heard a rock fall in the vicinity of Cathedral Rocks. She did not see any falling rocks or dust but reported the rumbling sound as quite loud. Kanes believed the rock fall occurred from within or near the large gully between Cathedral Spires and Higher Cathedral Rock; a more exact source area was not determined.

2009042701 Tenaya Canyon Quarter Domes RF Spring 4/27/2009 medium

According to Park Geologist Greg Stock: Report from park visitors in Tenaya Canyon upstream of Mirror Lake of a rock fall in the vicinity of Hidden Falls, from the south wall of Tenaya Canyon near Quarter Domes. The visitors did not see the event but heard loud rock fall sounds and saw a dust cloud rise from the canyon below Quarter Domes a few minutes later.

2009050101 Glacier Point Curry Village RF Spring 5/1/2009 small

According to Gary Linowski, construction manager at Curry Village (oral commun., 2 May 2009): A rock fall occurred behind Curry Village, approximately near the source area of the 8 October 2008 Ledge Trail rock fall. Linowski heard multiple rocks falling. The event occurred during rain, specifically when the rain intensified to large (approximately centimeter-sized) drops, suggesting a precipitation trigger.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2009050301 Glacier Point Glacier Point Apron RF Spring 5/2-3/2009 small

According to Park Geologist Greg Stock: Several reports from climbers posting on the Supertopo.com Forum described fresh rock fall debris at the base of Goodrich Pinnacle on the northeastern side of the Glacier Point Apron. The source area was possibly slightly above the pinnacle. The approximate volume of fresh rock debris at the base of the pinnacle was estimated to be 6-10 m³, in several large blocks (1-2 m maximum dimension) and many smaller fragments. The approximate timing of the rock fall was estimated based on the first reports of fresh talus and from earlier photographs, but the exact timing could not be determined. Given the uncertainties in both location and timing, a triggering mechanism could not be determined.

2009050302 Glacier Point LeConte Gully RF Spring 5/3/2009 small

(1) According to Valley Law Enforcement Ranger Mike Foster (oral commun., 3 May 2009): A rock fall occurred near LeConte Gully behind the LeConte Memorial Lodge. The exact source area could not be determined due to darkness and low clouds. No fresh rock debris was found on the talus behind the lodge. The event followed two days of warm heavy rain, suggesting a precipitation trigger. (2) According to Valerie Zimmer (written commun., 8 May 2009): "... I [Zimmer] heard a rock fall on Saturday night (in North Pines), around midnight (or, just after on Sunday morning). It was as loud as I would have expected, which makes me think that it was either small, or far away... It seemed to come from the Glacier Point direction. There was another bizarre sound maybe 5 minutes before the rock fall as well - I can't place it, but it was similar to a rifle sound, but much longer duration, lower frequency, and without the dropoff in amplitude typical of a rifle shot... Sue [Boudreau] came up to me a few days later and reported it as an explosion plus rock fall, and it seemed to be louder at Housekeeping [Camp] - very similar to my account."

2009050303 Half Dome Ahwiyah Point RF Spring 5/3/2009 small

According to Valerie Zimmer (written commun., 8 May 2009): A rock fall occurred from the Ahwiyah Point area, likely from the 28 March 2009 source area. Zimmer reports that two friends, Scott Stromberg and John Werner, were hiking in Tenaya Canyon upstream of Mirror Lake and heard the sound of small rocks falling, followed by the loud, concussive sound of a large rock impact. There was light rain at the time, and low clouds and mist prohibited direct observation of the cliff. However, their description of the impact (a "baritone crack ... a deep-sounding crack") suggests a volume of at least 10 m³, and likely more.

2009050901 Indian Canyon Lehamite Falls RF Spring 5/9/2009 small

According to National Park Service Interpretive Ranger Ben Cunningham-Summerfield (oral commun., May 2009): A rock fall occurred from the cliff just southwest of Lehamite Falls in Indian Canyon. Impact of rock debris at the base of the cliff produced a small dust cloud visible from Yosemite Village. The rock fall followed several days of rain, suggesting precipitation as the most likely trigger.

2009051701 El Capitan Southeast Face RF Spring 5/17/2009 small

According to Park Geologist Greg Stock: Independent reports from Sonja Dickinson and from a climbing team on route "Pacific Ocean Wall" on El Capitan of a rock fall from the southeast face of El Capitan, which landed in the vicinity of the start of the routes "Tangerine Trip" and "Native Son". Both reports suggest that the rock fall likely originated near the lip of the southeast face.

2009051702 Crocker Point Stanford Point RF Spring 5/17/2009 small

According to Park Geologist Greg Stock: Climbers on the route "Pacific Ocean Wall" on El Capitan reported a rock fall that originated from the west of Leaning Tower in the vicinity of Stanford Point.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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Impact of the rock debris on the cliff produced a small dust cloud. Snowmelt is considered a possible trigger for this rock fall.

2009052701 El Capitan Southwest Face RF Spring 5/27/2009 medium

According to Park Geologist Greg Stock: A medium-sized rock fall occurred from the west face of El Capitan above El Capitan Gully, reported by numerous climbers and visitors who witnessed the event from El Capitan Meadow. A sizable dust cloud was produced as debris fell down the upper, lower-angle part of the west face. The source area was near the lip of the west face, northwest of climbing route "Lurking Fear" and southeast of KP Pinnacle. All of the debris stayed within El Capitan gully. Snowmelt was a possible trigger.

2009052702 Glacier Point LeConte Gully RF Spring 5/27/2009 small

According to Park Geologist Greg Stock: Several reports of a rock fall from southwest of the Curry Village housing area, likely in Lower LeConte Gully. Andy Steele (National Park Service Interpretation) and Andy Hoekel (YOSAR) heard a short but loud rumble lasting approximately 10 seconds, but could not observe falling rocks in the dark. An exact source area was not determined.

2009053001 El Capitan Southeast Face RF Spring 5/30/2009 extremely small

According to Brendan Harrison (oral commun., June 2009): An approximately 0.2 m³ rock fell from the upper part of the North America Wall on the southeast face of El Capitan. Rock debris hit the talus at the start of the route. The rock fall occurred during heavy rain, suggesting a precipitation trigger.

2009063001 Glacier Point Happy Isles RF Summer 6/30/2009 small

According to Park Geologist Greg Stock: A rock fall was reported as occurring from Glacier Point, at or near the 1996 Happy Isles rock-fall source area. The event was described by witnesses as being about "half the size of a VW van" (~5-8 m³) and lasting more than 1 minute, presumably due to several individual rocks falling over a one minute time period. The weather was very warm with light rain. No trigger was recognized.

2009063002 Cathedral Rocks Middle Cathedral Rock RF Summer 6/30/2009 small

According to Park Geologist Greg Stock: A rock fall occurred from the east face of Middle Cathedral Rock. Approximately 20 m³ fell, all of which stayed on the talus slope below the east face. The weather was very warm temperatures with light rain. No trigger was recognized.

2009070701 Tenaya Lake Tenaya Peak RF Summer 7/7/2009 very small

According to Harrison Forrester (oral commun., July 2009): A small rock fall occurred from the cirque east of Tenaya Peak. Forrester was servicing the Tenaya snow pillow east of the Tenaya Lake beach and observed a single boulder, approximately 3 m³ in volume, falling from the cirque wall and impacting the first few pitches of the climbing route up Tenaya Peak. The weather was sunny, with mild temperatures. No trigger was recognized.

2009071001 Indian Canyon Castle Cliffs RF Summer 7/10/2009 small

According to Caitlin Lee-Roney, National Park Service Bear Technician (oral commun., July 2009): A rock fall occurred from the Castle Cliffs area behind the wildlife building in Yosemite Village, originating near Arrowhead Arête. Lee-Roney described a rock approximately 5 m³ in volume that fell more than 100 m to the talus at the base of the cliff, but she was not able to precisely locate the source area. The weather was clear, sunny, and warm, with no recent precipitation. No trigger was recognized.

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2009071801 Half Dome Porcelain Wall RF Summer 7/18/2009 medium

According to Park Geologist Greg Stock: Witnesses on the road to Mirror Lake reported a rock fall from within a steep gully east of the Porcelain Wall and west of Half Dome, at or near the bat-shaped rock fall scar left by earlier rock fall events. This rock fall produced a substantial dust cloud which was captured on video by park visitors. The weather was clear, sunny, and very warm (~100 degrees Fahrenheit). Thermal stress was a possible trigger. After the event an approximately 5 m³ flake remained hanging above the top of the source area.

2009072001 El Capitan Manure Pile Buttress RF Summer 7/20/2009 very small

According to Park Geologist Greg Stock: A small rock fall was reported from Manure Pile Buttress. The weather was sunny, clear, and hot. The trigger may have been related to thermal stress.

2009072002 Glacier Point n/a RF Summer 7/20/2009 very small

According to Park Geologist Greg Stock: Rock fall sounds were reported from Glacier Point, but the exact source area could be identified in the dark. The weather was clear and hot, with no recent precipitation; the triggering mechanism was possibly thermal stress.

2009072301 Half Dome Porcelain Wall RF Summer 7/23/2009 small

According to Park Geologist Greg Stock: Stock heard a rock fall at approximately 02:00 from Yosemite Village, emanating from Tenaya Canyon. Investigation by him later that morning showed the approximately 5 m³ flake hanging above the 18 July 2009 Porcelain Wall rock fall [see ID 2009071801] source area was missing from the wall.

2009080601 Crocker Point Old Inspiration Point RS Summer 8/6/2009 medium

According to Floyd Hayes (written commun., 31 January 2010): Hayes witnessed a rock slide from the Discovery View lookout on the east side of the Wawona Road tunnel. A photograph of the dust cloud and runout path shows the point of origin was near the rim of the south wall of the valley within a steep gully immediately east of Old Inspiration Point. Impact of rock debris at the base of the cliff produced a sizable dust cloud. The rock fall volume was unknown, but is estimated from the photograph to be approximately 100 m³. The photograph shows sunny, dry weather; no trigger was recognized.

2009082301 Grizzly Peak Grizzly Peak RF Summer 8/23/2009 small

According to Park Geologist Greg Stock: There were several reports of audible rock fall sounds in eastern Yosemite Valley, but an exact source area could not be determined due to low clouds. Stock heard the rock fall while on an early morning walk. Although low clouds and rain prohibited direct observation, he estimated the source area being on the western shoulder of Half Dome. Rock climber Josh Helling, on Glacier Point at the time, estimated more specifically that the rock fall originated near Grizzly Point. The rumble lasted approximately 15 seconds. Based on the rock-fall sounds, the volume was estimated to be approximately 20 m³. The event was preceded by 12 hours of light but sustained rain, which was the first rain in approximately 2 months. Precipitation was the most likely trigger.

2009082302 Half Dome Ahwiyah Point RF Summer 8/23/2009 small

According to National Park Service Interpretive Ranger Phil Johnson (written commun., 23 August 2009): Report from visitors in Lower Pines Campground of a rock fall occurring in Tenaya Canyon, likely from the Ahwiyah Point source area. Low clouds blocked the view of the source area, but rock fall sounds lasted approximately 15 seconds. A likely source at Ahwiyah Point was corroborated by National Park Service Interpreter Keri Leahman who heard the rock fall from Mirror Lake. The event occurred during a summer rain storm, suggesting precipitation as a likely trigger.

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2009082303 Indian Canyon Indian Canyon RF Summer 8/23/2009 small

According to Yosemite Institute instructor Jeff Crow (oral commun., 24 August 2009): A rock fall occurred in Indian Canyon. Crow heard a loud rumble and observed a small dust cloud on the east wall of Indian Canyon. The volume is approximately 20 m³. The rock fall occurred after approximately 16 hours of light but sustained rain, the first precipitation in approximately 2 months; precipitation was the most likely trigger.

2009082601 Royal Arches Rhombus Wall RF Summer 8/26/2009 small

(1) According to Park Geologist Greg Stock: A small rock fall was heard in eastern Yosemite Valley, mostly by residents of DNC housing near Ahwahnee Meadow of visitors staying at the Ahwahnee Hotel. Reported possible locations ranged from Indian Canyon to Washington Column. The reports suggested 3 separate events lasting approximately 25 seconds. This event initiated a series of larger rock falls from the Rhombus Wall later that same day. (2) From Stock et al. (2012a): "The first event of the Rhombus Wall rock fall sequence was a small rock fall that occurred at approximately 04:15 PST on 26 August 2009. The rock fall was not witnessed directly given its early morning occurrence, but several residents living near the Rhombus Wall heard the impacts of falling rock onto the talus slope. A comparison of photographs taken later that morning at 07:30 PST with the gigapixel panoramic images of the Rhombus Wall acquired prior to the rock fall reveals that the failure occurred at the inside corner of an alcove roof beneath an overhanging rock slab... The failure surface showed mostly freshly broken rock with ragged edges and no clearly defined pre-existing structural discontinuities. Local water staining on the newly exposed surface, however, indicates that a fracture behind the rock mass was open and conducting water, and had partially detached the rock mass from the cliff prior to failure."

2009082602 Royal Arches Rhombus Wall RF Summer 8/26/2009 small

(1) According to Park Geologist Greg Stock: The next rock fall in the series from the Rhombus Wall on 26 August 2009 occurred at approximately 12:30 PST, and originated as planar (slab) failures propagating up and west (left as viewed from the Ahwahnee Hotel) from the area that had failed earlier that morning (ID 2009082601). The failure occurred along sheeting joint extending beneath the roof. Several rock falls of tens of cubic meters fell in quick succession from beneath this roof. All of the detached rock fragments fell a short distance from the roof, struck a minor ledge, broke up into pieces, and then free fell ~250 m to the top of the talus slope below the Rhombus Wall. A National Park Service trail crew working on the Valley Loop trail just east of the Ahwahnee Hotel escaped without injury. (2) From Stock et al. (2012a): "... beginning at approximately 12:30 PST, a series of three rock falls, separated in time by approximately 20-60 seconds, began at the initial failure area and propagated up and to the west along a sub-planar, near-vertical sheeting joint that closely mirrored the orientation of the cliff face prior to failure."

2009082603 Royal Arches Rhombus Wall RF Summer 8/26/2009 small

From Stock et al. (2012a): "... beginning at approximately 12:30 PST, a series of three rock falls, separated in time by approximately 20-60 seconds, began at the initial failure area and propagated up and to the west along a sub-planar, near-vertical sheeting joint that closely mirrored the orientation of the cliff face prior to failure. A park visitor captured the rock fall at 12:31 PST on high-definition video. Analysis of this video reveals a sudden distinctive ejection of rock dust just as a rock sheet begins to slip along the underlying sheeting joint surface, with associated tensile failure within the slab. The apparently explosive behavior indicates the presence and rapid distribution of high stresses at the failure surface. The detached sheet subsequently slid down a steeply inclined surface below the failure surface (dip/dip direction: 69°/217°) for ~20 m and then struck a bedrock ledge. The sheet fragmented into about 14 large pieces and free-fell approximately 140 m to the talus slope at the base of the cliff."

[This was the next in a series of rock falls from the Rhombus Wall that occurred in quick succession. Numerous oak trees were destroyed as boulders up to several meters in diameter bounced and rolled down the talus slope.]

2009082604 Royal Arches Rhombus Wall RF Summer 8/26/2009 medium

From Stock et al. (2012a): "... beginning at approximately 12:30 PST, a series of three rock falls, separated in time by approximately 20-60 seconds, began at the initial failure area and propagated up and to the west along a sub-planar, near-vertical sheeting joint that closely mirrored the orientation of the cliff face prior to failure. " [This was the next in a series of rock falls from the Rhombus Wall that occurred in quick succession.]

2009082605 Royal Arches Rhombus Wall RF Summer 8/26/2009 large

(1) According to Park Geologist Greg Stock and Brian Collins of the U.S. Geological Survey: This was the largest in the series of rock falls from the Rhombus Wall on 26 August 2009. This rock mass was approximately 558 m³ in volume as determined by repeat photography and laser scanning, and was captured by numerous photographers throughout eastern Yosemite Valley. The majority of the debris that traveled beyond the edge of the talus slope landed just east of the valet parking gate and just west of the Royal Arches Creek streambed. Five vehicles were damaged in this area, including a minivan that was fully penetrated by an approximately 0.2 m³ rock fragment, but there were no injuries. The largest boulder that extended beyond the edge of the talus slope, approximately 1.5 m³ in volume, landed in the Royal Arches Creek streambed just upstream of the small bridge leading to the valet parking area. The farthest traveled boulder was approximately 20 m southeast of the streambed. Several 1-2 m³ boulders were documented in the talus north of the bear boxes and the bedrock mortar boulder along the Valley Loop Trail. Debris in this area was generally stopped by large boulders on the margin of the talus. Judging from the location of broken tree limbs, high up nearby tree trunks at the base of the talus, the rock fall boulders that reached beyond the talus followed fairly steep incoming trajectories before then bouncing along the valley floor where they impacted several trees before coming to rest. Several flyrock fragments smaller than baseballs landed in the paved parking area north and northeast of the Ahwahnee reflecting pond, but there were no injuries or vehicle damage in this area. Photos of the source area immediately after the failure show water present on the detachment surface in several discrete streaks. However, it is not clear whether this water was involved in triggering the initial rock fall, or whether the water was simply revealed on the detachment surface by a failure incited by some other mechanism. There was some seepage from beneath the new roof formed by the rock falls that was visible by spotting scope only; the seepage persisted until 31 August 2009, decreasing slightly each day. Regardless of the initial triggering mechanism, it seems likely that the subsequent rock falls were the result of stress redistribution following earlier rock falls, hence the progressive nature of the event occurring over minutes and hours. The detachment surface was roughly triangular in shape, with maximum dimensions of 36.5 by 13.5 m. Terrestrial LiDAR-based measurements of the new roof formed by the rock falls suggest that the failed slab was approximately 3 m thick. Subsequent ground-based laser scanning of the cliff by Brian Collins of the U.S. Geological Survey, and comparison with airborne laser scanning data collected prior to the failure, revealed a cumulative volume for all of the rock falls occurring on 26 August 2009 of 740 m³. UTM coordinates for the apex of the rock-fall source area are 273319.21E 4181246.66N (NAD83 zone 11N), with an elevation of 1576.05 m. (2) From Stock et al. (2012a): "At 13:09 PST, a much larger rock fall occurred above and west of the earlier failures, along the same sheeting joint surface. This slab had a volume of approximately 558 m³, the largest of all of the 2009-2010 Rhombus Wall rock falls. This rock fall was widely documented by park visitors, employees, and residents throughout eastern Yosemite Valley. Rock debris, including boulders as large as 2 m in

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diameter, bounced and rolled to the base of the talus slope and damaged unoccupied vehicles in the parking lot of the Ahwahnee Hotel."

2009082606 Royal Arches Rhombus Wall RF Summer 8/26/2009 medium

From Stock et al. (2012a): "A smaller rock fall occurred at 14:35 PST. Although this rock fall continued the progression of failures up and to the west, the failure surface 'stepped up' to a parallel sheeting joint that had formed shallower with respect to the cliff face; as a result, this rock fall consisted of a much thinner sheet than the failures earlier in the day." [This was the final rock fall from the Rhombus Wall on 26 August 2009.]

2009091401 Royal Arches Rhombus Wall RF Summer 9/14/2009 medium

(1) According to Park Geologist Greg Stock: A rock fall occurred from the Rhombus Wall, immediately adjacent to the 26 August 2009 rock-fall source area (see ID 2009082606). Numerous parties reported the rock fall from the Ahwahnee Hotel, and the resulting dust cloud was widely visible throughout the eastern part of Yosemite Valley. No rock debris reached the Ahwahnee parking lot. The rock fall originated from the rock face immediately above and slightly east of the overhanging roof created by the 26 August 2009 events. The failed rock mass consisted of a triangular slab approximately 35 x 12 x <1 m (maximum dimensions). The detachment surface was a J1 sheeting joint less than 1 m below the pre-failure cliff surface, and was distinct from (shallower than) the detachment surface of the 26 August 2009 rock falls. Repeat photography and laser scanning of the source area revealed the volume to be 108 m³. This failure was preceded by several weeks of cracking sounds, as well as visible expansion of the crack aperture behind the failed slab. Failure was likely related to crack propagation due to stress redistribution in response to the earlier failures, but beyond that there were no obvious triggers; the weather was clear with mild temperatures, and the source area was dry at the time of failure, though dark brown water stains were present on the detachment surface. (2) From Stock et al. (2012a): "Over the next 3 weeks [following the 26 August 2009 rock falls], cracking sounds were heard emanating from the Rhombus Wall from as far away as 1 km on at least four occasions, although they could not be definitively tied to the location of the 26 August 2009 rock falls. Visual monitoring from the ground and by helicopter during this period indicated that the aperture of a sheeting joint just beneath the cliff surface above the overhang created by the 26 August 2009 rock falls irreversibly widened by several centimeters... A 17:12 PST on 14 September 2009 a rock mass with a volume of 108 m³ detached along the aforementioned sheeting joint. The joint was essentially parallel to the failure surface of the 26 August 2009 rock falls, but located at a much shallower depth (0.8 versus 3.1 m). The failure surface of the 14 September 2009 rock fall is an eastward continuation of the failure surface of the last rock fall that occurred on 26 August 2009. As with the earlier failures, the exposed failure surface shows some water staining, primarily near its center, with freshly fractured rock along the perimeter. Although the failure surface was dry when observed within 10 minutes after the rock fall occurred, the presence of water staining indicates that the sheeting joint was at least partially open and transmitting water behind the sheet for some time prior to the failure."

2009092901 Glacier Point Staircase Falls RF Fall 9/29/2009 medium

According to Park Geologist Greg Stock: A rock fall occurred from the cliff west of and below the Ledge Trail and Staircase Falls, east of LeConte Gully, and south of the Curry Village Housing Area. Rumbling sounds lasted approximately 10 seconds, and the event produced a large and persistent dust cloud. Very small (~3 cm³) flyrock fragments landed in the parking area between the Housing Area and the talus slope, and there was no damage to vehicles or infrastructure. All other rock debris was contained within the talus slope. The rock fall originated from the west side of the 25 October 2005 rock-fall

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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source area [ID 2005102501]. The volume was estimated to be approximately 55 m³. The weather was cool and cloudy but there was no measurable precipitation. No trigger was recognized.

2009100501 Royal Arches Royal Arches RF Fall 10/5/2009 small

According to Park Geologist Greg Stock: A park visitor reported a rock fall from near the Royal Arches climbing route, east of the Rhombus Wall and the "Serenity Crack/Sons of Yesterday" climbing route. The visitor described "12 to 15 large boulders" falling down the cliff. The weather at the time of the rock fall was clear and cool, but the event followed approximately 0.5 cm of rain on 4 October. National Park Service Interpretive Ranger Karen Amstutz also witnessed the rock fall and provided a similar description.

2009101301 Royal Arches Royal Arches RF Fall 10/13/2009 small

According to Park Geologist Greg Stock: A rock fall was reported from the cliff near Royal Arches, east of the "Serenity Crack/Sons of Yesterday" climbing routes and west of the "Royal Arches" climbing route. Low clouds obscured the source area, but a small dust cloud was still visible. The rock fall likely involved failure of one of the many sheeting joint-bounded slabs that form ledges in this area of the cliff. The rock fall occurred during a rain event, suggesting precipitation as a likely trigger.

2009101302 Union Point Chapel Wall RF Fall 10/13/2009 medium

According to Park Geologist Greg Stock: A rock fall was reported from the Chapel Wall, the cliff south of the Chapel. The event lasted approximately 1 minute and the witness saw individual boulders falling over the cliff from the lower angle slope above. Precipitation was the likely trigger.

2009101303 Merced River Gorge Reed's Pinnacle RF Fall 10/13/2009 very small

According to Park Geologist Greg Stock: A rock fall fell onto Big Oak Flat Road near Reed's Pinnacle. The volume was approximately 2 m³. The rock fall occurred during a rain storm, suggesting precipitation as the likely trigger.

2009101304 Merced River Gorge El Portal Road / Windy Point RF Fall 10/13/2009 small

According to Park Geologist Greg Stock: A rock fall occurred on the hillslope above El Portal Road near Windy Point, and small rocks landed on both lanes of the road. The volume was approximately 6 m³. The rock fall occurred during a rain storm, suggesting precipitation as the most likely trigger.

2009101305 Parkwide n/a RF/DF Fall 10/13-15/2009 medium

According to Park Geologist Greg Stock: Numerous small rock falls and debris flows occurred throughout the park associated with approximately 15 cm of rain that fell during a two day storm with warm temperatures (snowline was at approximately 2,700 m).

2009101306 Giant Staircase Grizzly Peak RF Fall 10/13/2009 extremely small

According to Mara Dale (written commun., 14 October 2009): Yosemite Institute instructor Katharine Simon observed a small rock fall on the Mist Trail. Simon was with a student group downstream of the Vernal Fall footbridge when a "basketball-sized chunk" of rock fell onto the trail between member of the group. There were no injuries. The rock fall occurred during a rain storm, suggesting precipitation as the most likely trigger.

2009101401 Indian Canyon Castle Cliffs RF Fall 10/14/2009 small

According to Park Geologist Greg Stock: Stock heard a rock fall from the north wall of the valley at or near Castle Cliffs that lasted approximately 15 seconds. The exact source area was not determined but appeared to have been below and west of Arrowhead Arête. Precipitation was the likely trigger.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2009101402	Merced River Gorge	Big Oak Flat Road	RF	Fall 10/14/2009	very small
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According to Park Geologist Greg Stock: A 2 m³ rock fell onto Big Oak Flat Road east of the long (westernmost) tunnel. Precipitation was the most likely trigger.

2009101403	Glacier Point	Housekeeping Camp	DF	Fall 10/14/2009	small
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According to Park Geologist Greg Stock: A precipitation-triggered debris flow occurred from an unnamed drainage west of LeConte Lodge and south of Housekeeping Camp. Rain falling on the bare bedrock cliffs above the drainage quickly converged to form substantial runoff that mobilized enough rock debris to become a debris flow. The flow incised up to 1 m through predominantly rock-fall debris on the talus slope, mobilizing the smaller (sand to cobble-sized) debris and leaving cobble and small boulder levees up to 0.5 m high above the channel. At the distal edge of the talus slope, the flow bifurcated and deposited sand, gravel, and mud. Sand and mud were deposited on Northside Drive near Housekeeping Camp to a depth of approximately 15 cm. There was little or no sediment deposition farther downslope within Housekeeping Camp. The total debris flow volume was approximately 25 m³.

2009101501	Merced River Gorge	El Portal Road / Parkline	RF	Fall 10/15/2009	very small
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According to Park Geologist Greg Stock: A rock fall occurred just west of the park boundary on Highway 140 (outside the park) and east of Yosemite View Lodge. The source area was on the hillslope approximately 30 m above the north side of the road. Boulders approximately 2 m³ in volume landed on both lanes of the road; Cal Trans subsequently removed the rocks. Precipitation is considered to be the most likely trigger.

2009101701	El Capitan	Southeast Face	RF	Fall 10/17/2009	small
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According to Park Geologist Greg Stock: A rock fall was reported from the vicinity of the climbing route "Shortest Straw" on the eastern side of the southeast face of El Capitan. Climbers familiar with the route suggest that the source area may have been along the fifth pitch of the route, roughly 250 m above the base of the cliff.

2009101702	El Capitan	Southeast Face	RF	Fall 10/17/2009	very small
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According to Park Geologist Greg Stock: A rock fall occurred from the roof above El Capitan Tree on the southeast face of El Capitan. Some blocks rolled down the talus slope approximately 100 m. The weather was clear and warm but followed approximately 15 cm of rain on 13-14 October 2009. Precipitation is considered the most likely trigger for this rock fall.

2009102801	Illilouette Gorge	Illilouette Creek	RF	Fall 10/28/2009	small
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According to Park Geologist Greg Stock: A rock fall was reported in the Illilouette Gorge below Illilouette Falls. The exact location and volume were unknown. The event occurred after the first night of freezing temperatures since the beginning of the summer season.

2009110601	Merced River Gorge	Big Oak Flat Road	RS	Fall 11/6/2009	very small
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According to Park Geologist Greg Stock: Approximately 2 m³ of rock debris fell onto the Big Oak Flat Road, about a quarter mile west of the junction with El Portal Road. A small failure occurred from the road cut on the north side of the road.

2009111001	Illilouette Gorge	Illilouette Gorge	RF	Fall 11/10/2009	very large
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According to Park Geologist Greg Stock: The U.S. Geological Survey reported a very shallow earthquake near Illilouette Gorge, which had a similar magnitude and depth to the earthquake which caused the 28 March 2009 Ahwiyah Point rock fall, suggesting a rock fall may have occurred on 10 November 2009 in

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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or near Illilouette Gorge. Subsequent observation from Sierra Point, however, failed to show evidence of a recent rock fall in this area.

2009121101 Hetch Hetchy Wapama Falls RF Fall 12/11/2009 medium

According to Mather District Law Enforcement Ranger Greg Moore (written commun., 17 December 2009): A rock fall occurred from the steep cliff immediately west of Wapama Falls near Hetch Hetchy Reservoir. Fresh rock debris was reported by hikers on 12 December 2009 and confirmed by Mather Law Enforcement Rangers the following day. Subsequent investigation revealed numerous boulders on and adjacent to the Wapama Falls Trail, some up to 2.5 m in diameter, discontinuously over a distance of about 200 m. Trail retaining walls sustained damage in several locations. A few smaller boulders appear to have entered the reservoir. The failed rock mass consisted of an irregular, vertically-oriented slab roughly 18 x 3 x 1.5 m (80 m³) that fell from beneath a prominent roof midway up the cliff, below and slightly east of a solitary oak tree growing from the cliff. Because the exact timing of the event is unknown, an exact trigger cannot be known; however, the detachment surface displayed seepage for several days after the event, suggesting precipitation as a possible trigger.

2009122301 Royal Arches Rhombus Wall RF Winter 12/23/2009 very small

(1) According to Park Geologist Greg Stock: Park Dispatch conveyed a report of a small rock fall from the Rhombus Wall, near the 26 August 2009 rock-fall source area. A valet parking attendant at the Ahwahnee Hotel witnessed the event and confirmed that it was rock, notice, that fell, even though there was a substantial amount of ice on the cliff above the source area at that time. (2) From Stock et al. (2012a): "The Rhombus Wall rock-fall source area was inactive for most of the winter 2009 and spring 2010, except for a very small rock fall that occurred at 09:10 PST on 23 December 2009. This event was heard but not directly observed. Initial attempts to visually locate the source of this rock fall was unsuccessful, as the area immediately adjacent to the failure surfaces of 26 August and 14 September 2009 rock falls did not display obvious changes. Subsequent terrestrial laser scanning and difference analysis with the previous terrestrial scan revealed a small (4 m³) volume change 12 m above the 14 September 2009 failure surface. Because this rock fall did not share an adjacent surface with an earlier rock fall, and because it occurred during alternating wet and freezing conditions, we consider the possibility that this rock fall may not have been directly related to the earlier failures in 2009 and instead was a distinctly different event, like the many other small rock falls triggered by winter storms in 2009-2010. However, we cannot rule out the possibility that this rock fall was influenced by stress redistribution resulting from the 26 August and/or 14 September 2009 rock falls."

2009122501 Royal Arches Rhombus Wall RF Winter 12/25/2009 very small

According to Valley Law Enforcement Ranger Matt Stark (oral commun., 25 December 2009): Another small rock fall occurred from the Rhombus Wall source area. An exact source area for this rock fall could not be determined, but it may be the same as the rock fall of 23 December 2009 [see ID 2009111001 and Stock et al., 2012a]. Freeze-thaw was a possible trigger.

2009122701 Glacier Point Curry Village RF Winter 12/27/2009 small

According to Valley Law Enforcement Ranger Mike Siler (oral commun., 27 December 2009): A rock fall occurred from Glacier Point, behind Curry Village. Low clouds obscured the cliffs and the exact source area could not be identified. A concession employee estimated the volume, according to the sound, as "approximately one dump truck load", or roughly 20 m³.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010011801 Merced River Gorge El Portal RS Winter 1/18/2010 very small

(1) According to National Park Service Roads and Trails chief Tim Ludington (written commun., 19 January 2010): A rock fall occurred from the grassy hillslope northwest of the National Park Service El Portal maintenance facility, directly upslope of the fuel pumps. Rock debris (consisting of schist and quartzite) impacted the parking lot on either side of the pumps, and one approximately 0.2 m³ rock landed across the road on the sidewalk. The total volume of rock debris was approximately 2 m³. (2) According to Park Geologist Greg Stock: Subsequent investigation by Stock revealed the source area to be about two-thirds of the way up the hillslope north of the gas pumps. The source area was quite small in extent; the failure was a single 2 m³ block that slid when the surrounding soil reached saturation. The failure occurred after substantial rainfall; precipitation was the most likely trigger.

2010012101 Indian Canyon Church Bowl RF Winter 1/21/2010 small

According to Park Geologist Greg Stock: A rock fall was reported by a Valley Law Enforcement Ranger as occurring from the broken cliff between Church Bowl on the west and the Rhombus Wall on the east. The ranger could not see the fall due to darkness and heavy snow, but clearly heard the event. An exact source area was not determined. The volume was relatively small, less than 10 m³, and the trigger was likely related to heavy snowfall.

2010021801 Yosemite Falls Sunnyside Bench RF Winter 2/18/2010 very small

According to National Park Service trail worker Remo Fickler (written commun., 22 February 2010): A rock fall occurred from Sunnyside Bench, east of Lower Yosemite Falls. Fickler and Erin Anders witnessed the event and investigated the trail to the Lower Falls. They found about 2 m³ of rock debris on the talus slope approximately 120 m east of the climbing route Jamcrack and about 60 m upslope of the western side of the housing area.

2010031401 Glacier Point Curry Village RF Winter 3/14/2010 small

According to Park Geologist Greg Stock: A rock fall was reported from Glacier Point. The event was not seen because it was dark, but it was heard. The sound lasted between 20 and 120 seconds, depending on the listener, and the source area was placed at or near the 8 October 2008 Ledge Trail rock fall source area. However, subsequent investigation did not reveal any change at that source area. In addition, snow on the Ledge Trail was not disturbed. There were not any obvious changes to the 1998-1999 Curry Village or 2003-2007 Staircase Falls source areas. The exact source area and volume were not determined; approximate volume of 10 m³. The weather was warm with daily melting and nightly freezing; possible freeze-thaw trigger.

2010033001 Yosemite Falls Yosemite Falls Trail RF Spring 3/30/2010 very small

According to Park Geologist Greg Stock: A very small rock fall occurred from the lower part of Forbidden Wall, west of the central portion of the Yosemite Falls Trail between Columbia Point and the start of the upper switchbacks in the gully. The event consisted of several small blocks totaling between 0.5-1 m³ in volume. A Yosemite Institute (YI) group was hiking the trail at that location and two students were struck by rock debris, received relatively minor injuries. One student self-evacuated and the other, who sustained upper leg injuries, was carried out by YOSAR. The event occurred after about 6 hours of steady rain following 10 days of clear weather. Precipitation was the most likely trigger. The exact source area was undetermined, but was likely less than 200 m above the trail, as the YI instructors only heard rock fall sounds for about 5 seconds before rock debris landed on the trail.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010033002 Yosemite Falls Yosemite Falls Trail RF Spring 3/30/2010 extremely small

According to Park Geologist Greg Stock: A very small rock fall occurred on the Yosemite Falls Trail. Less than 0.2 m³ of fresh rock debris was found on the trail.

2010040301 Yosemite Falls Yosemite Falls Trail RF Spring 4/3/2010 very small

According to Park Geologist Greg Stock: A small rock fall was reported "above Columbia Point" on the Yosemite Falls Trail.

2010041001 Glacier Point LeConte Gully RF Spring 4/10/2010 small

According to Park Geologist Greg Stock: Numerous reports of a rock fall in LeConte Gully. National Park Service employee Jim Bacon witnessed the event from DNC housing near Ahwahnee Meadow and described 3-5 large boulders (approximate volume 35 m³) falling into lower LeConte Gully from about 150 m up the cliff on the northwest side of the gully. Debris impacts produced a small dust cloud. No rock debris extended beyond the talus slope below LeConte Gully. The weather was clear and warm following substantial snow. Snowmelt was the probably trigger.

2010041601 Tenaya Canyon n/a RF Spring 4/16/2010 small

According to Park Geologist Greg Stock: Several campers in the Pines Campgrounds reported hearing a loud rumbling from Tenaya Canyon. Subsequent observations from Mirror Lake did not reveal obvious new rock fall source areas in lower Tenaya Canyon.

2010041801 Half Dome Northwest Face RF Spring 4/18/2010 small

According to Park Geologist Greg Stock: Visitors reported a series of small rock falls from the northwest face of Half Dome, in the vicinity of the regular northwest face climbing route. The approximate cumulative volume was 10 m³. The rock falls occurred between storms, and precipitation was the likely trigger.

2010042201 El Capitan Southeast Face RF Spring 4/22/2010 small

According to Park Geologist Greg Stock: A rock fall was reported from the southeast face of El Capitan. Witnesses heard low rumbling sounds of a rock fall from El Capitan Meadow, but were unable to see the source area or any falling rocks due to low clouds. Shouts were heard from climbers on the climbing route "Zodiac", but there was no indication how close they were to the fall path. No injuries were reported. The exact source area on the southeast face was not determined. The exact volume is unknown but was probably approximately 20 m³ based on descriptions of the sound of the rock fall. The event occurred after two days of rain and snow (4.35 cm of precipitation on 20 April and 0.23 cm on 21 April 2010). Precipitation and/or freeze-thaw are considered probable triggers for this rock fall.

2010042202 Glacier Point Curry Village RF Spring 4/22/2010 small

According to DNC Interpreter Cory Goehring (written commun., 22 April 2010): Goehring was hiking to Mirror Lake when he heard a rock fall from Glacier Point, most likely from above Curry Village. An exact source area was not determined.

2010050301 Three Brothers Middle Brother RF Spring 5/3/2010 small

According to Park Geologist Greg Stock: A small rock fall was reported as occurring from the southeast face of Middle Brother. Rocks were heard falling from Leidig Meadow, and a small dust cloud was observed from this location. The volume was approximately 5 m³. The trigger was unknown.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010051801 Glacier Point LeConte Gully RF Spring 5/18/2010 very small

According to Park Geologist Greg Stock: A small rock fall was reported from the lower LeConte Gully area. Rocks were reportedly small, less than 2 m³, and did not extend far beyond the base of the cliff. Precipitation and snowmelt were possible triggers

2010052401 Yosemite Falls Yosemite Falls Trail RF Spring 5/24/2010 small

According to Park Geologist Greg Stock: A rock fall was reported from the eastern, lower portion of the Camp 4 Wall, above the lower switchbacks of the Yosemite Falls Trail before it traverses east to Columbia Point. A witness heard rock fall sounds lasting about 7 seconds and saw a small dust cloud. Several boulders were reported on and across the Falls Trail. The source area was on the western side of the terraced buttress west of Columbia Point and above the large gully that is east of the first trail switchbacks about 250 m above the top of the talus. The volume was approximately 15 m³. The weather was cool and cloudy with several days of light rain and snow preceding the event. The source area was dry at 08:40 PST, however, precipitation and/or freeze-thaw were still possible but not with a high degree of certainty.

2010070701 Three Brothers n/a RF Summer 7/7/2010 small

According to Park Geologist Greg Stock: Several witnesses described rock fall sounds in the vicinity of El Capitan and Three Brothers. One witness described a loud, thunderous sound "lasting about 1 minute" west of Camp Four. Others described several distinct cracking sounds followed by thunderous booms lasting "about 30 seconds". They put the approximate location east of the East Buttress of El Capitan. Subsequent investigation failed to identify the exact source area. A thunderstorm with short but intense precipitation occurred around 18:00 and was a possible trigger. Otherwise, the trigger may have been related to thermal stress.

2010071701 Tioga Pass Mount Dana RF Summer 7/17/2010 very small

According to Park Geologist Greg Stock: Stock was climbing the Third Pillar of Mount Dana and witnessed a rock fall from the next rock buttress to the south, just outside the park boundary. A single rock of about 3 m³ fell approximately 150 m to the talus on the basin floor. The weather was warm and clear, and the trigger was possibly snowmelt and/or thaw related.

2010071702 Mount Conness Mount Conness RF Summer 7/17/2010 small

According to Park Geologist Greg Stock: A climber reported a rock fall from within or near the "Y Couloir" on Mount Conness. He witnessed the event from the summit of Mt. Conness and described seeing several "car-sized" boulders (~30 m³) sliding down the snow on the Conness Glacier. The weather was warm and clear, and the trigger was possibly snowmelt/thaw. The event occurred just outside the park boundary.

2010072301 Glacier Point Curry Village RF Summer 7/23/2010 very small

According to Park Geologist Greg Stock: A small rock fall was reported from Glacier Point above the western portion of the Glacier Point Apron. Witnesses describe the source area as being "high up, near the rim". The approximate volume was 3-5 m³. No debris reached the talus slope near Curry Village. Subsequent observation failed to identify an exact source area. The weather was clear and warm. The trigger was unrecognized, but may have been related to thermal stress.

2010072302 Cathedral Range Cathedral Peak RF Summer 7/23/2010 small

According to Park Geologist Greg Stock: Visitors observed rocks tumbling down the west-facing slope of Cathedral Peak for about 10 seconds. The volume was approximately 10 m³ based on their description.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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The weather was clear and warm; the trigger was possibly related thermal stressing of an exfoliation slab, which are common on the west-facing slope of Cathedral Peak.

2010072401 Half Dome Porcelain Wall RF Summer 7/24/2010 medium

According to Park Geologist Greg Stock: A rock fall occurred from the middle of Porcelain Wall. Numerous witnesses along the road to Mirror Lake saw the event and took digital photographs. The rock fall originated from about midway up the Porcelain Wall (~500 m up) and lasted 25-30 seconds. No debris appeared to have reached the base of the talus, likely due to the substantial impact on the ledge below the source area. The failure consisted of a flake in an east-facing corner midway of the cliff where the cliff is vertical to slightly overhanging. The failure occurred as two distinct slabs approximately 10 x 5 x 2 and 5 x 5 x 2 m in dimension and approximately 150 m³ in cumulative volume. The weather was clear and hot with direct sun, and no recent precipitation; the detachment surface was dry in photos taken during and immediately after the event. The trigger was possibly thermal stress.

2010080901 Half Dome Ahwiyah Point RF Summer 8/9/2010 small

According to Park Geologist Greg Stock: A rock fall occurred from Ahwiyah Point. Witnesses at Mirror Lake described several rocks falling from near the top of Ahwiyah Point for about 20 seconds. Stock responded at 07:45 and observed a lingering dust cloud. The exact source area was not determined, but was almost certainly within the previous source area and fall path of the 28 March 2009 [ID 2009032801] and subsequent rock falls. Based on the description and dust cloud, the volume was approximately 20 m³. The weather was clear and cool with no sun on Ahwiyah Point; no trigger was recognized.

2010081801 Union Point Four Mile Trail RF Summer 8/18/2010 very small

According to Park Geologist Greg Stock: A small rock fall was reported from the diagonal cliff band above the lower Four Mile Trail switchbacks west of the Chapel Wall and east of Sentinel Rock. Witness Brittany Woidersky (National Park Service Resource Management and Science) was in Sentinel Meadow near Chapel Straight heard and then saw a single boulder about 3-5 m³ in volume fall from the top of the cliff band, impact a ledge, and fragment into many pieces, which produced a small dust cloud. The weather was clear and warm, and the trigger was unrecognized.

2010082401 Union Point Chapel Wall RF Summer 8/24/2010 very small

According to Park Geologist Greg Stock: A rock fall was reported by Brittany Woidersky (National Park Service Resource Management and Science) who observed the event from Sentinel Meadow. The fall originated from the top of the Chapel Wall south of the Chapel, within a zone of highly fractured and grussified rock. This area was the same approximate source area as the 27 March 2006 Chapel Wall rock fall [ID 2006032701]. The witness photographed a small dust cloud at the top of the wall and suggested an approximate volume of 3 m³. Another witness heard "popping" sounds immediately before detachment. The weather was clear and hot, and thermal stress was a possible trigger.

2010083001 Royal Arches Rhombus Wall RF Summer 8/30/2010 small

(1) According to Park Geologist Greg Stock: Eyewitness reports described a loud rumbling in the dark lasting approximately 20 seconds from the vicinity of the Rhombus Wall. Subsequent investigation at daylight revealed the source area to be within the general source area of the 26 August 2009 rock falls. The 30 August 2010 rock falls originated from the far left (west) side of the 26 August 2009 source area, underneath a large water-stained overhang. The failed slabs were thin blocks much taller than wide. The weather was clear and cool with no recent precipitation. No trigger was recognized, although Stock et al. (2012a) propose a triggering mechanism associated with stress redistribution and propagation of

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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sheeting joints. (2) From Stock et al. (2012a): "Rock-fall activity [at the Rhombus Wall] resumed at 01:45 PST on 30 August 2010 with a failure generally progressing up and to the west. The failure involved a vertical slab of rock 0.8 m thick with a total volume of 30 m³ on the western edge of the failure surface of the 26 August 2009 rock falls."

2010090201 Yosemite Falls Yosemite Falls Trail RF Summer 9/2/2010 small

According to Park Geologist Greg Stock: A rock fall was reported by a witness at the Yosemite Lodge who saw a rock fall from the south rim of the valley, west of the lip of Yosemite Falls and just east of a point in-line with Yosemite Lodge, Columbia Point, and the south rim. The witness heard rock fall sounds and observed a dust cloud. A field check of the Yosemite Falls Trail did not reveal any fresh rock debris on the trail. The volume was estimated to be approximately 10-20 m³. The weather was clear and warm, with no recent precipitation. The trigger was unrecognized.

2010090202 Indian Canyon Indian Canyon RF Summer 9/2/2010 small

According to Park Geologist Greg Stock: Two separate witnesses reported a small rock fall heard in the middle of the night, from Yosemite Village (Ranger Club) and upper National Park Service housing. One account placed the location on the east wall of Indian Canyon and described hearing a single boulder tumbling down the slope for about 10-15 seconds. The volume was estimated to be approximately 5-10 m³. The weather was clear and cool, with no recent precipitation. The trigger was unrecognized.

2010090301 Glacier Point Ledge Trail RF Summer 9/3/2010 small

According to Park Geologist Greg Stock: A rock fall was reported from Glacier Point behind Curry Village. A Valley Law Enforcement Ranger reported a single block that fell from the 8 October 2008 rock fall source area onto the Ledge Trail, which produced a small dust cloud. Numerous park visitors observed the rock fall and dust cloud. No debris visibly traveled beyond (downslope of) the Ledge Trail ledge. Subsequent observation revealed the source area to be within the 10/2008 source area on the left (eastern) side below the concavity left by the failure of the thickest part of the slab on 10/8/2008. The block was approximately 5 x 5 x 2 m (20 m³). A walk through the closed portion of Curry Village did not reveal any fresh rock debris there. The weather was clear and warm with no recent precipitation. The trigger was unrecognized, but may have been related to thermal stress.

2010090701 El Capitan Nose RF Summer 9/7/2010 very small

According to Park Geologist Greg Stock: A rock fall was reported on or near "The Nose" climbing route on El Capitan. The witness was in the trees near the Devil's Elbow and could not see the event, but heard a single boulder falling and impacting ledges for several seconds. The exact source area and volume were unknown, but the volume was probably less than 2 m³. The fall was possibly caused by climbers but no shouts of "rock" were heard. The weather was clear and warm. The trigger was unrecognized.

2010090702 North Dome/Washington Column Washington Column RF Summer 9/7/2010 small

According to Park Geologist Greg Stock: A rock fall was reported near the summit of Washington Column. A climber on pitch 5 of climbing route "The Prow" believed the event initiated near the top of the routes "Reanimator" and/or "Skull Queen". The rock impacted the cliff near pitch 7 of "Reanimator", then fell to the base of the cliff and broke into additional fragments. The climber described about 4 fragments each approximately 1 m³ plus another flake also approximately 1 m³, for a total estimated volume of 5 m³. No injuries were sustained despite the many climbing parties located on the cliff and at the base. The weather was clear and warm. No trigger was recognized.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010090801 Half Dome Ahwiyah Point RF Summer 9/8/2010 small

According to Park Geologist Greg Stock: A visitor reported another rock fall from the same source area as the 28 March 2009 rock fall from Ahwiyah Point. The visitor reported 15-20 seconds of rock fall sounds and a substantial dust cloud. The volume was unknown, but was likely approximately 20 m³. The weather was cool and cloudy with no rain that followed a much warmer period. The trigger was unrecognized.

2010091801 El Capitan Nose RF Summer 9/18/2010 very small

According to Park Geologist Greg Stock: A small rock fall, approximately 2 m³, was reported on or near the Nose climbing route on El Capitan. The event occurred during a YOSAR helicopter operation on El Capitan but was unrelated. No injuries were reported. The weather was clear and warm. The trigger was unrecognized.

2010092701 Royal Arches Rhombus Wall RF Fall 9/27/2010 small

(1) According to Park Geologist Greg Stock: A Valley Law Enforcement Ranger reported a rock fall from the Rhombus Wall, within or very near to the source area of the 26 August 2009 rock falls. A visitor witnessed rocks falling from the "upper-left" side of the source area, and a small dust cloud from the impacts on the talus was produced. No debris reached the base of the talus slope. The weather was clear, sunny, and unseasonably warm (approximately 90 degrees Fahrenheit). (2) From Stock et al. (2012a): "... at 13:30 PST on 27 September 2010, a 0.8 m thick sheet 43 m³ in volume detached from a position directly above the 30 August 2009 failure. This event reflects fracture propagation along the western margin of the [Rhombus Wall] failure area, predominantly upward behind the cliff face but also slightly to the west."

2010100001 Royal Arches Rhombus Wall RF Fall 10-11/n/a/2010 small

(1) According to Park Geologist Greg Stock: Repeat photography and laser scanning of the Rhombus Wall between 28 October 2010 and 12 November 2010 revealed loss of a small rock slab adjacent to and above the 14 September 2009 failure on the Rhombus Wall. An exact trigger is unknown, but it may have been related to stress redistribution and resulting sheeting joint propagation behind the failed slab. (2) From Stock et al. (2012a): "Difference analysis following a terrestrial scan on 14 December 2010 revealed an additional rock fall that had not been previously documented. This failure consisted of a thin (0.5 m) sheet with a volume of 14 m³, located above the 14 September 2009 failure surface. Repeat photographs show that this sheet was in place on 28 October 2010, but missing on 12 November 2010. Although there were no reports of rock falls from the Rhombus Wall during this time, many small rock falls that occur in Yosemite Valley are not reported. Perhaps this sheet also failed on 12 November 2010, along with [ID 2010111201] on the western margin, but we are unable to test that possibility with the available data. Therefore, we cannot identify an exact date or time for this rock fall. However, its position adjacent to an earlier failure, and its occurrence during a period of high rock-fall activity on the Rhombus Wall, strongly suggest that it was related to the other failures. This failure was interesting in that it occurred on the eastern side of the rock-fall source area after a hiatus in activity on the side of more than one year."

2010100201 Cathedral Rocks Cathedral Gully DF Fall 10/2/2010 medium

According to Park Geologist Greg Stock: A debris flow occurred in the gully between Cathedral Spires and Higher Cathedral Rock. Witnesses on Southside Drive observed an approximately 40 cm tall wall of muddy water, sediment, and woody debris that washed across Southside Drive west of the El Capitan crossover. Approximately 20 m³ of sand was deposited on Southside Drive. Boulders up to 2 m in diameter were mobilized by the event, and small boulder levees 80 cm tall formed where the flow

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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transitioned from incision to deposition, about 100 m upslope of Southside Drive. The upper gully experienced up to 2 m of incision. Heavy rain triggered the debris flow; rainfall at the Yosemite Valley station measured only 0.43 cm, but witnesses observed waterfalls pouring off of Middle Cathedral Rock as the rain abated, suggesting that precipitation was locally much greater there.

2010100202 El Capitan Southeast Face RF Fall 10/2-3/2010 small

According to Park Geologist Greg Stock: Climbers on the El Capitan route "Plastic Surgery Disaster" report a large rock fall in the middle of the night. They could not see it due to darkness and rain but heard it fall from the cliff east of the route "Zodiac" on the southeast face, near the path of Horsetail Falls. Horsetail Falls was running at a high discharge during the event due to an intense rain event on 2-4 October 2010 (cumulative 4.64 cm of rain during that period). Subsequent observation two days later revealed fresh talus at the base of Horsetail Falls and two new source areas roughly halfway up the cliff, in line with the path of Horsetail Falls. The two source areas were separated by a tall pillar that subsequently failed on 11 October 2010 [see IDs 2010101101-2010101201]. Given the time coincidence of the storm event and the rock fall, precipitation (possibly in the form of Horsetail Falls discharge) is the most likely trigger.

2010100401 Merced River Gorge Big Oak Flat Road/Rattlesnake DF Fall 10/4/2010 small

According to Park Geologist Greg Stock: A substantial debris flow was reported near Rattlesnake on Big Oak Flat Road. The volume was approximately 10 m³ of mostly sand from the hillslope above the road. The flow was triggered by several days of heavy rain 2-4 October 2010 (cumulative 4.64 cm of rain during that period).

2010100402 Merced River Gorge El Portal Road/Parkline RS Fall 10/4/2010 very small

According to Park Geologist Greg Stock: A small rock slide (approximately 2 m³) was reported on El Portal Road just east of the park boundary. The slide was likely triggered by several days of heavy rain 2-4 October 2010 (cumulative 4.64 cm of rain during that period).

2010100403 Cathedral Rocks Middle Cathedral Rock DF Fall 10/4/2010 medium

According to Park Geologist Greg Stock: Another debris flow was reported from the gully east of Middle Cathedral leading up to Cathedral Spires. Approximately 30 m³ of sand and gravel, up to 30 cm deep, covered both lanes of Southside Drive. Just upslope, about 250 m³ of coarser material, including boulders up to 1 m in diameter, were deposited on the toe of the existing fan, burying the Loop Trail. The flow created boulder levees up to 1.2 m high in this area, and the upper gully incised more than 2 m in places. The flow was triggered by several days of heavy rain 2-4 October 2010 (cumulative 4.64 cm of rain during that period).

2010100501 Indian Canyon Church Bowl RF Fall 10/5/2010 very small

According to Park Geologist Greg Stock: A small rock fall from the cliff at Church Bowl with associated injuries was reported to Park Dispatch by witnesses at Church Bowl. The event occurred from the cliff north-northwest of the climbing route "Black is Brown", and the source area was low on the cliff, approximately 15 m above the top of the talus slope. The fall consisted of a rock slab approximately 2 m tall x 2 m wide x 0.5 m thick, which toppled from its position on the cliff and fell to the talus, breaking into two pieces and striking an oak tree. At the time of the rock fall, three local children (Serra Weber, Carmen Ortiz, and Angel Ortiz) were playing on the talus slope at the exact spot of impact. The largest rock fragment fell directly onto Weber, coming to rest against the oak tree but partially pinning her beneath the rock and causing several life-threatening injuries. Her companions ran to the nearby Yosemite Medical Clinic and notified the medical staff, who responded immediately. Weber was flown

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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to a local hospital where she recovered for several weeks. The rock fall occurred just as a storm, which delivered 4.64 cm of precipitation in the first major storm event of the fall season, was clearing. The detachment surface did show some seepage when observed several hours after the rock fall, and the weathered rock and soil upon which the slab rested was saturated. It appears that the partially detached slab shifted slightly on the saturated soil that it rested on, then toppled over. Precipitation is considered to be the most likely trigger for this rock fall.

2010100901 Three Brothers Middle Brother RF Fall 10/9/2010 small

According to Park Geologist Greg Stock: A rock fall was reported from Middle Brother, approximately above "The Good Book" climbing route. The volume was unknown, but based on the description of the dust cloud it was likely greater than or equal to 10 m³. The weather was clear but followed several days of precipitation; precipitation was the most likely trigger.

2010100902 Yosemite Falls Columbia Rock RF Fall 10/9/2010 very small

According to Park Geologist Greg Stock: A small rock fall was reported on the straight section of the Yosemite Falls Trail between the top of the lower switchbacks and Columbia Point. The witness described 3-4 "soccer ball-sized" rocks and smaller debris (~0.5 m³). Precipitation was the most likely trigger.

2010101001 Indian Canyon Church Bowl RF Fall 10/10/2010 very small

According to rock climber Ellen Lapham (written commun., October 2010): Lapham was climbing the route "Black is Brown" at the northwestern edge of Church Bowl when three big rocks fell just to her right. She believes they came off the tree-covered ledge at the top of the climb, about 50 m up, and were natural (i.e., not climber caused). The rocks struck the base of the cliff between "Black is Brown" and the route "Church Bowl Lieback". Several climbers at the base ran for cover, but there were no reported injuries. The cumulative volume was approximately 1 m³. The weather was clear and mild but followed several days of intense precipitation; precipitation was the most likely trigger.

2010101002 Three Brothers Middle Brother RF Fall 10/10/2010 small

According to Park Geologist Greg Stock: Report from a park visitor at Yosemite Point of a rock fall from Middle Brother. He heard a sudden, large rock fall and took a photo of the dust cloud and likely impact area on the main large talus slope beneath Middle Brother. The exact source area was unknown, but it was likely from the upper portion of the cliff, within or near the March 1987 rock-fall source area. The volume was estimated to be approximately 20 m³. The weather was clear and mild but followed several days of intense precipitation; precipitation was the most likely trigger.

2010101101 El Capitan Southeast Face RF Fall 10/11/2010 very small

According to Kait Barber (written commun., October 2010): A small rock fall from the southeast face of El Capitan. Barber and her climbing partner were bivouacked at the base of El Capitan before starting the route "Bad Seed", and were both awakened by rock fall sounds coming from the cliff to the east of them, approximately near the path of Horsetail Falls. The sound was not particularly loud but lasted several seconds; Barber estimates the volume to be approximately 2 m³. This rock fall, whose trigger is unrecognized, was a precursor to the much larger rock falls that occurred at the same location later in the day.

2010101102 El Capitan Southeast Face RF Fall 10/11/2010 medium

According to Park Geologist Greg Stock: Numerous reports from witnesses in El Capitan Meadow, and from climbers on El Capitan itself, of a rock fall from the southeast face of El Capitan, approximately

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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along the path of Horsetail Falls and midway up the cliff. Climber Sean Leary witnessed the event from El Capitan Meadow, and described one large flake peeling away from the cliff, falling to the prominent ledge at the base of the main wall, and breaking up into multiple pieces, many of which continued over the next cliff (Endless Summer Wall) and down to the talus slope on the Valley floor.

2010101103 El Capitan Southeast Face RF Fall 10/11/2010 large

(1) According to Park Geologist Greg Stock: This was the largest rock fall in the sequence of rock falls from the southeast face of El Capitan on 11 October 2010. The event was widely witnessed by visitors in El Capitan Meadow and climbers on the southeast face of El Capitan, in part because of the smaller rock fall that occurred from the same location about two minutes earlier. The failure surface was roughly triangular in shape, approximately 33 m tall and 40 m wide at the base, with an approximate thickness of 1.5 m, for a total volume of approximately 990 m³. Rock climber Adam Long observed the rock fall while climbing on the southeast face of El Capitan, and clearly observed the slab fail by shear (rather than toppling) as a single intact slab. The slab fell parallel to the cliff face about 200 m before impacting a large ledge at the base of the cliff, fragmenting into numerous boulders and producing a large dust cloud. These boulders then bounced and rolled over the cliff below the ledge (along the path of lower Horsetail Fall) to impact the talus slope at the base of the cliff. No fresh rock debris went beyond the base of the talus. The dust cloud was visible throughout Yosemite Valley for approximately 30 minutes after the rock fall occurred. The weather was clear and mild, and the detachment surface was dry when observed immediately after the failure occurred. No trigger is recognized; however, this failure was likely associated with earlier failures from the same location, suggesting fracture propagation associated with stress redistribution from earlier rock falls. (2) A photograph of this rock fall by Adam Long is published in McNamara and van Leuven (2011).

2010101104 El Capitan Southeast Face RF Fall 10/11/2010 small

According to Park Geologist Greg Stock: Numerous reports from witnesses in El Capitan Meadow of another small rock fall occurred from the Horsetail Falls source area about two minutes after the largest failure.

2010101105 El Capitan Southeast Face RF Fall 10/11/2010 small

According to Park Geologist Greg Stock: Another small rock fall occurred from the Horsetail Falls source area on the southeast face of El Capitan about 1.5 hours after the largest event. I [Stock] witnessed the event from the Valley Loop trail below the southeast face, and saw a thin flake fall from the lower right (eastern) corner of the source area, fall to the prominent ledge at the base of the main cliff, and break up into many smaller pieces. Boulders up to 1-2 m³ in volume continued over this ledge and down to the talus at the floor of the valley.

2010101201 El Capitan Southeast Face RF Fall 10/12/2010 small

According to Kait Barber (written commun., October 2010): Another rock fall occurred from the southeast face of El Capitan, originating from the same source area active the previous day [see IDs 2010101101-2010101105]. Barber and her climbing partner Ammon McNeely were several pitches up the climbing route "Bad Seed" and were sleeping in their portaledge when they were awakened by rock fall sounds. Barber states that these sounds were second in loudness after the largest event at 10:32 PST on 11 October 2010, suggesting an approximate volume of 80 m³. This rather large volume suggests that the rock fall did not simply consist of loose material falling from a ledge, but rather represented a new detachment from the cliff. As with the other rock falls in this sequence, an exact trigger was not determined; however, failure was almost certainly associated with stress redistribution following the earlier rock falls.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010101202 Yosemite Falls Yosemite Falls Trail RF Fall 10/12/2010 small

According to National Park Service Biological Science Technician Kate Wilkin (written commun., 12 October 2010): Wilkin was hiking the Upper Yosemite Falls Trail and witnessed a small rock fall "about 3 to 4 slightly larger than soccer ball-sized rocks with smaller debris." The rock fall occurred between Columbia Point and the switchbacks to the west.

2010102801 Royal Arches Rhombus Wall RF Fall 10/28/2010 small

(1) According to Park Geologist Greg Stock: A "moderate to large" rock fall was reported from the Rhombus Wall. The source area could not be seen due to darkness, but DNC staff indicated that the sounds emanated from the vicinity of the 26 August 2009 source area. No fresh rock debris was found in the parking area or along the Valley loop trail in that area. Subsequent observation on the morning of 29 October revealed that the rock fall occurred on the far western (climber's left) side of the original 26 August 2009 rock fall scar, and continued the westward propagation of the subsequent 30 August 2010 and 27 September 2010 failures. No trigger was recognized, but Stock et al. (2012a) suggest that these rock falls may have been triggered by stress redistribution resulting from previous rock falls, causing propagation of sheeting joints. (2) From Stock et al. (2012a): "...at 20:05 PST on 28 October 2010, another rock fall occurred from the far western margin of the [Rhombus Wall] failure area. As with the previous rock falls from this area, the failed sheet was thin (0.6 m), with a total volume of 33 m³."

2010111001 Cathedral Rocks Middle Cathedral Rock RF Fall 11/10/2010 very small

According to Park Geologist Greg Stock: A rock fall was reported from Middle Cathedral Rock, with debris landing on Southside Drive. Approximately eight boulders up to 0.5 m³ (2-3 m³ total volume) in volume were scattered on the roadway beneath the North Buttress, west of the Central Pillar climbing route "Central Pillar of Frenzy". The only damage was a small impact crater on the roadway; here a boulder roughly 30 cm in diameter imbedded itself into the roadbed with such force that the top of the boulder was even with road surface. The source area was uncertain due to low clouds. Precipitation was the most probable trigger.

2010111002 Merced River Gorge Big Oak Flat Road RF Fall 11/10/2010 very small

(1) According to Park Geologist Greg Stock: A rock fall was reported on Big Oak Flat Road, "1-2 miles east of the Big Oak Flat Road and El Portal Road junction". Several boulders fell onto the roadway, with up to 1 m³ in total volume. The road sustained minor damage from impacts. Precipitation was the likely trigger. (2) David Ballinger (National Park Service Vegetation Crew) heard the rock fall (5-10 seconds of rumbling) and described the location as between Reed's Pinnacle and Cascade Falls.

2010111201 Royal Arches Rhombus Wall RF Fall 11/12/2010 small

(1) According to Park Geologist Greg Stock: A "medium-to-large-sized" rock fall was reported from the Rhombus Wall by numerous parties in eastern Yosemite Valley. No flyrock or other rock debris was found beyond the base of the talus slope. Observation on the morning of 13 November 2010 revealed that the rock fall occurred on the western (climber's left) side of the 26 August 2009 rock fall scar, adjacent to (above) the scar from the 28 October 2010 rock fall. (2) From Stock et al. (2012a): "...at 16:42 PST on 12 November 2010, another rock fall occurred along the western margin of the [Rhombus Wall] failure area. This rock fall again involved a thin (0.6 m) rock sheet and had a volume of 40 m³. The failure surface connected those of previous rock falls, and partially overlapped the failure surface of the 27 September 2010 rock fall. We interpret this overlap as progressive failure along stacked, thinly spaced sheeting joints with nearly identical orientations (dip/dip direction)."

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2010111202 Three Brothers Middle Brother RF Fall 11/12/2010 small

According to Park Geologist Greg Stock: A climber bouldering near Camp Four reported a rock fall from Middle Brother in the vicinity of the climbing route "The Good Book". She reported hearing one loud boom followed by the sound of clattering rocks. This event was followed by another rock fall about 10 minutes later. The volume was approximately 10 m³. A specific triggering mechanism was not recognized.

2010111301 Royal Arches Rhombus Wall RF Fall 11/13/2010 small

(1) According to Park Geologist Greg Stock: A small rock fall occurred from the Rhombus Wall, consisting of the overhanging flake that was left unsupported by the 12 November 2010 rock fall. Park Geologist Greg Stock heard the rock fall from the National Park Service lower housing area and observed a small dust cloud enroute to the Ahwahnee Hotel. No flyrock or other rock debris was found beyond the base of the talus slope. (2) From Stock et al. (2012a): "...at 12:04 PST, another rock fall occurred on the western margin of the failure area. This rock fall, involving the same thin (0.6 m) sheet that failed the previous day, extended farther up the cliff. Its failure surface partially overlapped the failure surface of the 27 September 2010 rock fall. Cracking noises were heard from the Rhombus Wall approximately one hour prior to this failure, and the rock fall was widely throughout eastern Yosemite Valley."

2010111701 El Capitan Southeast Face RF Fall 11/17/2010 small

According to Park Geologist Greg Stock: A rock fall occurred from the southeast face of El Capitan, from the same source area as the 11 October 2010 rock fall [ID 2010101103]. Rock climber Josh Helling was in El Capitan Meadow and heard a cracking sound and saw rocks falling from the top of the 11 October 2010 source area. Rock climber Bryan Law witnessed the event from the base of the southeast face east side of the Footstool and saw several "refrigerator-door-sized" rocks falling down the cliff and bouncing off the prominent ledge at the bottom of the cliff. The volume was approximately 5 m³. The weather was clear and mild, and the trigger is unrecognized but probably associated with stress redistribution following the 11 October 2010 and subsequent smaller rock falls. The source area was from the upper right (east) corner of the 11 October 2010 source area.

2010111901 Glacier Point n/a RF Fall 11/19/2010 very small

According to Park Geologist Greg Stock: A rock fall was reported from Glacier Point. A bystander near Indian Cave heard several blocks clattering down the cliff below Glacier Point lasting about 5 seconds. The volume was approximately 4 m³. The exact source area was unknown, and a specific trigger was unrecognized.

2010112001 Royal Arches Rhombus Wall RF Fall 11/20/2010 small

(1) According to Park Geologist Greg Stock: A small rock fall was reported by the DNC staff at the Ahwahnee Hotel, originating from the Rhombus Wall area. The event was not directly observed due to darkness, but rock fall sounds lasted 3-5 seconds. No flyrock or other rock debris was found beyond the base of the talus slope. (2) From Stock et al. (2012a): "The final rock fall of the 2009-2010 Rhombus Wall sequence occurred at 22:55 PST on 20 November 2010. This failure, which had a volume of approximately 2 m³, involved a very thin (0.2 m) sheet located on the eastern side of the 13 November 2010 failure."

2010120301 Three Brothers n/a RF Fall 12/3/2010 small

According to Park Geologist Greg Stock: Numerous reports were recorded from residents in Yosemite Village of a loud rumble from the west of Yosemite Falls lasting approximately 8-10 seconds. The

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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weather was dark and stormy, so the source area could not be immediately identified. Subsequent investigation failed to yield an exact source area.

2010120501 Indian Canyon Indian Canyon RF Fall 12/5/2010 small

According to Park Geologist Greg Stock: Residents in National Park Service Upper Housing reported a rock fall from the Indian Canyon Area. Rock fall sounds were reported as being very loud and lasting about 10 seconds. Immediate reconnaissance was limited due to darkness and driving rain. Subsequent investigation the following morning along the Valley Loop Trail between the National Park Service Stables and Church Bowl did not reveal any fresh rock debris. The likely source area was on the east wall of Indian Canyon, south of Lehamite Falls. The volume was approximately 20 m³, based on the sound. The failure occurred after substantial rain (0.08 cm of precipitation on 4 December and 3.12 cm on 5 December 2010). Precipitation is considered the most likely trigger for this rock fall.

2010120601 Merced River Gorge Big Oak Flat Road/Rattlesnake RF Fall 12/6/2010 very small

According to Park Geologist Greg Stock: A small rock fall, approximately 1 m³ in volume, occurred on Big Oak Flat Road from the north wall of the road cut at Rattlesnake. The failure was from an area of densely fractured granite about 5 m above the road bed. The detachment surface was wet, and the weather was clear following intense precipitation overnight (3.12 cm of precipitation on 5 December 2010). Precipitation is considered the most likely trigger for the rock fall.

2010120701 Merced River Gorge Big Oak Flat Road / Rattlesnake RF Fall 12/7/2010 small

According to Park Geologist Greg Stock: A second, larger rock fall occurred from the same road cut on the Big Oak Flat Road as the 6 December 2010 rock fall (north wall of the road cut at Rattlesnake, see ID 2010120601). Approximately 38 m³ of rock debris stretched across both lanes of the road. The detachment surface was wet, and precipitation is a possible trigger; however, the failure was more likely related to destabilization following the 6 December 2010 rock fall. The road was closed for approximately 3 hours while the debris was cleared.

2010120801 Glacier Point LeConte Gully RF Fall 12/8/2010 very small

According to Park Geologist Greg Stock: Rock fall sounds were heard for about 8 seconds from the cliff above and southwest of LeConte Gully. The volume was relatively small, about 2 m³, and the event occurred during intense rain and warming temperatures. The trigger was likely precipitation and/or freeze thaw.

2010122101 Hetch Hetchy Hetch Hetchy Road RS Fall 12/21/2010 small

According to Joe Meyer, National Park Service Resources Management and Science (oral commun., December 2012): A rock slide occurred from a steep road cut above the Hetch Hetchy Road, approximately 3/4 of the way between the Hetch Hetchy Entrance Station and O'Shaughnessy Dam. The failure originated approximately 5 m above the road and consisted of a rock slab approximately 5 x 5 x 1 m (25 m³). Rock debris covered both lanes of the road. Prominent live oak roots were exposed on the detachment surface, suggesting that root wedging may have played a role in the failure. However, ice and snow were also present and are considered possible triggers.

2010122301 Sentinel Rock Sentinel Creek DS Winter 12/23/2010 small

Report from Valley Law Enforcement Ranger Fletcher Ogg of a debris slide in the vicinity of Sentinel Rock. Several witnesses near Swinging Bridge heard a loud rumbling, but an exact source area was not determined. Subsequent investigation suggest that the failure occurred within the weathered bedrock and/or till near Sentinel Creek. The volume was approximately 20 m³. This event sourced from the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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same location as the failures in 2003 [ID 2003122201]. 0.89 cm of precipitation fell on 22 December 2010 and is considered to be the most likely trigger.

2010122901	Merced River Gorge	El Portal Road / Windy Point	RS	Winter	12/29-30/2010	medium
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According to Park Geologist Greg Stock: A rock slide occurred midway up the north-facing canyon wall opposite Windy Point. An approximately 60 m³ block fell from the top of a rounded cliff and slid about 65 m into a gully, breaking up into several large boulders. The impact of this block into the gully appears to have triggered failure of a large (~25 m³) rounded boulder sitting on the convex slope just below and east of the initial source area, as this boulder clearly slid into the gully (based on comparison of before and after photos) but was not along the fall path of the main rock fall, suggesting it was shaken down. The cumulative debris from both sources moved down the gully to where it widens out on a ledge, and from there rolled and tumbled out of the gully and onto the forested hillslope below, destroying numerous canyon live oaks and leaving a large area of fresh talus. Seepage was present on the initial detachment surface when observed on 31 December 2010. Although the exact date and time of the event is not known, it is bracketed by observations on 28 and 31 December 2010. The failure followed several days of rain (5.13 cm on 28 December, 2.97 cm on 29 December, and 0.08 cm on 30 December 2010) and then very low (sub-freezing) temperatures. Precipitation and/or freeze thaw are therefore the most likely triggers.

2010123001	Merced River Gorge	El Portal Road / Windy Point	RS	Winter	12/30/2010	small
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According to Park Geologist Greg Stock: A rock slide occurred on El Portal Road down canyon from Windy Point, near Dog Rock. The failure initiated from a road cut that had been bolted during construction of El Portal Road in the late 1990s. Two bent bolts (rebar) were sheared by the sliding slab and left projecting from the detachment surface. The failed slab was approximately 4 x 2 x 1.5 m (12 m³), and slid down a joint plane dipping 45 degrees, sliding 2-3 m onto the road. Rock debris landed on both lanes (mostly the westbound lane) and caused some damage to the road surface. No injuries or vehicle accidents occurred. The detachment surface was wet immediately after the failure, and nearby joints had recently seeped water, though those seeps were frozen at the time of failure. The failure followed several days of rain (5.13 cm on 28 December, 2.97 cm on 29 December, and 0.08 cm on 30 December 2010) and then very low (sub-freezing) temperatures. Precipitation and/or freeze thaw are therefore the most likely triggers.

2011012601	Hetch Hetchy	Wapama Falls	RF	Winter	1/26/2011	very small
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According to Hetch Hetchy Law Enforcement Ranger Chris Smith (written commun., January 2011): A small rock fell on the Wapama Falls Trail about 1 km east of the tunnel beyond O'Shaughnessy Dam, at the first creek crossing. Smith described the single block on the trail as "4 x 3 feet" in size, about 1.5 m³ in volume.

2011013101	Rockslides	Rockslides	RF	Winter	1/31/2011	large
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According to Park Geologist Greg Stock: Report from rock climbers Ed Hartouni and Eric Gabel of a large rock fall from the Last Resort Cliff, located on the western edge of The Rockslides area and below "Rainbow View" on the Old Big Oak Flat Road. The failure area on the cliff was approximately 18 x 15 m, and about 3-4 m thick, for a total volume of about 950 m³ (this estimate is very approximate due to the irregular and complicated shape of the source area). The failure occurred at the base of the cliff. Fresh talus extended downslope below the cliff for at least 50 m, burying dozens of live oaks and some conifer trees under debris, but no debris reached Northside Drive. Failure of the cliff removed the climbing routes "Turning Point", "Sidekick", and "Tiger's Paw" (Reid, 1998). Gabel was the first to notice the rock

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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fall on 5 February 2011 and found a very fine, fresh layer of dust on everything in the area that had not yet been wetted down. Based on this, he estimated that the rock fall occurred recently, on or just after 31 January 2011. Photographs taken in mid-February show prominent seepage from two southwest-dipping joints in lower portion of the face, as well as from a shallowly south dipping joint along the base of the failure.

2011020501 Hetch Hetchy Eye in the Sky RF Winter 2/5/2011 medium

According to Park Geologist Greg Stock: Report from Park Dispatch of a very large" rock fall at Hetch Hetchy in the vicinity of the housing area near the dam. Darkness prohibited direct observation of the event but witnesses described 20-30 seconds of rumbling, followed by a thick dust cloud. Observation on the morning of 6 February 2011 clearly revealed the source area midway (~70 m) up the cliff on the "Eye in the Sky" formation above the housing area. The detachment surface was a vertically-oriented planar surface w/ orange and brown staining. Dimensions of the detachment surface are ~12 x 10 m; before photographs taken by Law Enforcement Ranger Chris Smith suggest a thickness of the failed slab of ~2 m. The detachment surface was dry upon observation at 08:30 on 6 February 2011. The failed slab appeared to have slid briefly along the detachment surface and then toppled, falling ~70 m to the base of the cliff and then breaking up into numerous fragments that rolled and bounced down the talus. Small (< 1 m³) fragments came to rest w/in 400 m horizontally and 40 m vertically of the southern edge of the housing area. The weather was clear and mild, with snowmelt during the day and sub-freezing temperatures at night. However, in the absence of obvious correlation with any specific trigger, a trigger is unrecognized.

2011021701 Hetch Hetchy Eye in the Sky RF Winter 2/17/2011 small

According to Hetch Hetchy Law Enforcement Ranger Chris Smith (oral commun., 17 February 2011): A rock fall occurred from the cliff south of the housing area near O'Shaughnessy Dam. Smith stated that the event was "large", but not as large as the 5 February 2011 event. A snow storm between 17 February and 25 February obscured the cliff and talus slope and an exact source area was not identified. Smith believed that rectangular scars to the west of the 5 February 2011 event may have been the source, but photo comparison failed to identify an obvious source in that area.

2011021801 Merced River Gorge El Portal/Foresta Road RS Winter 2/18-19/2011 very small

According to GeoCorps Intern David Santaniello (oral commun., February 2011): Two rock slides occurred on Foresta Road between Rancheria housing area and the El Portal Post Office. The slides occurred approximately 40 m apart from each other and both impacted the westbound lane of Foresta Road. The eastern slide had a volume of approximately 2 m³ and the western slide a volume of approximately 0.5 m³. Both rock slides occurred either in the late pm on 18 February or the early am on 19 February 2011. The weather was cold (near-freezing) with substantial rain and snow.

2011022501 Merced River Gorge El Portal/Foresta Road RS Winter 2/25/2011 extremely small

According to Park Geologist Greg Stock: Additional rock slides from the same two source areas as 18-19 February 2011 events.

2011030801 Glacier Point Happy Isles RF Winter 3/8/2011 very small

According to Yosemite Institute instructor Scott Borden (oral commun., 10 March 2011): A rock fall occurred from Glacier Point, originating at or near the 1996 Happy Isles source area. Borden observed several small rocks tumbling down the southeastern part of the Glacier Point Apron. No debris extended beyond the base of the talus slope.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2011031201	Indian Canyon	Indian Canyon	RF	Winter	3/12/2011	small
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According to Park Geologist Greg Stock: Stock was awakened in the National Park Service lower housing area by rock fall sounds lasting approximately 15 seconds. Several distinct rock impacts heard from the general vicinity of Indian Canyon. Subsequent investigation later that day did not reveal an obvious source area but the lack of reports from the Ahwahnee and other areas suggests Indian Canyon was the most likely location. The volume is estimated to be about 20 m³ based on the sounds. The weather was clear and cold, with snowmelt occurring during the day.

2011031202	Glacier Point	Glacier Point Apron	RF	Winter	3/12/2011	very small
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According to climber Rafael Silverman de la Vega (written commun., 24 April 2011): de la Vega had climbed "The Grack" with two partners and was rappelling down in the cliff in the dark. At 19:27, as he was searching for anchor bolts in the dark, de la Vega "felt rumbling through my shoes, and heard a noise like rushing water mixed with crashing... I looked up and saw a plume of dust ... directly above me. The rock fell in one second, it was not sustained. The dust cloud lifted quickly. I saw no rocks myself, neither did other members, but one person heard a softball sized rock whiz past his head."

2011032101	Merced River Gorge	El Portal Road/Windy Point	RS/ES	Spring	3/21-25/2011	small
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According to Park Geologist Greg Stock: Sometime during the intense storm of 21-25 March 2011, a rock slide and earth slide occurred from the south canyon wall opposite Windy Point in the Merced River Gorge. This source area is distinct from (west of) the 29-30 December 2010 rock slide that also occurred opposite Windy Point. The failure involved some rock but at least equally amounts of soil, as the slide path was quite brown and muddy.

2011032102	Merced River Gorge	El Portal Road	RS/ES	Spring	3/21-25/2011	medium
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According to Park Geologist Greg Stock: Numerous small rock slides and shallow landslides occurred in the El Portal area and Merced River Canyon downstream of the park boundary during the heavy snowfall of 21-25 March 2011. The vast majority of the failures occurred in colluvium along roadcuts. The largest slide volume was approximately 100 m³.

2011032103	Tenaya Canyon	Hidden Falls	SA	Spring	3/21-25/2011	small
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According to George Whitmore (written commun., 20 April 2011): "I [Whitmore] went up to Hidden Falls on Tenaya Creek about a week ago, and encountered the aftermath of what must have been a very impressive avalanche of snow, rock, and trees... The amount of rock which had been brought down was interesting. There was a very large amount of dirt on top of the reason, the reason for which was not self-evident. A lot of it had come down from the back side of Ahwiyah Point, and it ran almost to [Tenaya] Creek. Judging by the evidence, my impression is that this was an immense event, the likes of which are not seen very often in Yosemite. It certainly would have been frightening to be at Hidden Falls when the mountainside came thundering down. In addition to the snow/rock/tree avalanche, we noticed that a large area of bare rock slab had been stripped clean of the earth and shrubs which had been on it. This appeared to have been the result of water saturating the earth, as we did not discern any evidence that anything had come down from above to strip it out. Going by the condition of the uprooted vegetation, my guess is that this occurred during the last week of March, when we were getting all the wet snow down low." [The snow fall occurred 21-25 March 2011].

2011032501	Merced River Gorge	El Portal Road/Dog Rock	RF	Spring	3/25/2011	very small
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According to Park Geologist Greg Stock: A rock fall occurred from the road cut above El Portal Road just downhill of Dog Rock. This failure was along the same road cut as the 30 December 2010 failure but was

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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from a different source area. This source area was ~15 m downhill of the 30 December 2010 failure. A wedge ~4m³ in volume slid from beneath a roof down a dip-slope surface onto the road.

2011032502 Merced River Gorge El Portal / Foresta Road DS Spring 3/25/2011 large

According to Park Geologist Greg Stock: A debris slide occurred onto Foresta Road between Rancheria and El Portal, just west of the El Portal wood lot. The slide initiated from a tall (approximately 20 m) road cut and consisted of ~1,200 m³ of soil and angular metamorphic clasts (hillslope regolith) on top of weathered granitic bedrock. The cone of slide material covered both lanes of Foresta Road, up to 6-7 m deep on the northern (westbound) lane. Seepage was observed along the western portion of slide plane, and water drained from the slide mass after failure, suggesting saturated conditions. Failure followed several days of intense rain and heavy snow.

2011032503 Hetch Hetchy Wapama Falls RF Spring 3/25/2011 very small

According to Park Geologist Greg Stock: A National Park Service trail crew reported a rock fall from the steep cliff just west of Wapama Falls. They reported several fragments of fresh rock debris on the Wapama Falls trail, including one ~1 m³ boulder that damaged a wooden footbridge on the trail.

2011042001 Three Brothers Middle Brother RF Spring 4/20/2011 small

According to Park Geologist Greg Stock: Report from several campers in Camp 4 of a rock fall from Middle Brother, originating from within or very near to the 10 March 1987 scar. Witnesses reported seeing several blocks up to 3 m³ bouncing down ledges, followed by a small dust cloud. No debris reached Northside Drive.

2011042002 Three Brothers Middle Brother RF Spring 4/20/2011 small

According to Park Geologist Greg Stock: A smaller rock fall from Middle Brother occurred later the same evening [see ID 2011042001], again reported by campers in Camp 4. Witnesses heard the event but could not see it due to darkness. Based on the sound, they estimate this later rock fall to be roughly half the size of the event earlier that day.

2011050101 Glacier Point Happy Isles RF Spring 5/1/2011 small

According to National Park Service Interpretive Ranger Karen Powers (oral commun., May 2011): Powers was in Upper Pines Campground and heard approximately 30 seconds of rumbling with three discrete episodes, suggesting three individual impacts. She could not see an obvious dust cloud through the campfire smoke at the campground. She did not locate an exact source area, but felt that it was from Glacier Point, roughly above Happy Isles, east of the Glacier Point Apron. The weather was clear and mild with recent snowmelt.

2011052101 Cathedral Rocks Cathedral Gully RF Spring 5/21/2011 small

According to National Park Service Chief of Staff Mike Gautier (written commun., 24 May 2011): Gautier observed a rock fall from the unnamed cliff at the head of the gully between Cathedral Spires and Higher Cathedral Rock. He was descending from Higher Cathedral Spire when he heard and then saw a block approximately 1 m³ bouncing down the upper part of the gully. This boulder then dislodged other loose boulders in the gully, for a total mobilized volume of about 5 m³. The boulders rolled down the gully approximately 100 m, breaking many trees on the way down. The event lasted about 30 seconds. The weather was clear and cool with abundant snowmelt.

2011052701 Half Dome Northwest Face RF Spring 5/27/2011 small

According to Park Geologist Greg Stock: Reports from several witnesses of a rock fall from the Northwest Face of Half Dome. Numerous photographs and video were taken of the event from various

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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locations in the east valley. The rock fall originated from stacked exfoliation slabs at the top of the Northwest Face, west of the actual high point of the face (the "Diving Board"); the fall line of rock debris was just to the west of the prominent black water streaks on the face and the climbing route "Tis-sa-sack". The rocks impacted the cliff above the base and broke up into smaller pieces, which then hit the base of the cliff very hard, producing a small dust cloud that hovered near the base of the face for several minutes. Individual boulders could be heard tumbling down the steep bedrock slabs below the Northwest Face for more than one minute. No rock debris reached the floor of Tenaya Canyon or the Mirror Lake Loop Trail. The weather was partly cloudy and cool, with some recent precipitation.

2011061501 Half Dome Ahwiyah Point RF Spring 6/15/2011 small

According to Park Geologist Greg Stock: Reports of a rock fall from the Ahwiyah Point area "lasting about ten seconds". Description of the event suggests 5-10 m³ of material, possibly coming from loose material on ledges beneath the initial 28 March 2009 source area. Subsequent investigation failed to reveal an exact source area. No trigger could be identified but snowmelt was prevalent on the cliffs around Ahwiyah Point.

2011062101 Cathedral Rocks Lower Cathedral Rock RF Summer 6/21/2011 small

According to Park Geologist Greg Stock: Report from a Valley Law Enforcement Ranger of a small rock fall from Lower Cathedral Rock. The reporting party could not determine the exact source area and did not see any rocks falling, but heard rock fall sounds lasting about 10 seconds. The weather clear and warm.

2011062601 Indian Canyon Lehamite Falls RF Summer 6/26/2011 small

According to Park Geologist Greg Stock: Reports of a rock fall from the east wall of Indian Canyon in the vicinity of Lehamite Falls and near the rim of the canyon. Visitors heard rock fall sounds lasting 15-20 seconds and observed a dust cloud that lasted about 20 minutes. The weather was warm and clear.

2011062701 Giant Staircase Mist Trail RF Summer 6/27/2011 extremely small

According to Dirk Pluschke (written commun., 14 July 2011): Park visitor Pluschke was on the steep stair section of the Mist Trail, within trees just before the hand-railed section traversing to the top of Vernal Fall, when a one "basketball-sized" rock and several "tennis ball-sized" rocks fell from the cliff south of the trail. The rock hit the side of the cliff and broke into smaller pieces, one of which hit Pluschke on the back, narrowly missing his head. He sustained a bruise on his back. The weather was warm and clear.

2011062901 Glacier Point n/a RF Summer 6/29/2011 small

According to Marty Acree, National Park Service vegetation crew (written commun., 2011): Acree was with a group of three others in eastern Yosemite Valley when all of them heard a distinct rumbling sound. However, low clouds and drizzle obscured views of the cliffs. The consensus of the group was that the rock fall originated from the Glacier Point area, but a more specific source could not be identified.

2011070101 Glacier Point Ledge Trail RF Summer 7/1/2011 small

According to Park Geologist Greg Stock: Numerous reports of a rock fall from Glacier Point, mostly coming from the Curry Village area but throughout eastern Yosemite Valley. Reports describe rumbling sounds that lasted approximately 30 seconds. Subsequent investigation at daylight revealed the source of the rock fall to be from the upper west (upper right when viewed from Stoneman Meadow) portion of the scar left by the 8 October 2008 rock fall. The failed block consisted of a rectangular block ~10 m tall, 2.5 m wide, and 1 m thick. The block free-fell for ~200 m and landed on the Ledge Trail ledge. Debris

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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continued down the ledge but stopped on the talus behind Curry Village. Weather clear with mild temps. Short but intense rain three days prior to the rock fall. However the source area was dry when viewed at ~7:00 on 1 July 2011. Some brown staining on the detachment surface, suggesting previous water flow. Although a specific triggering mechanism is not recognized for this rock fall, the block was likely destabilized by the 8 October 2008 rock fall. It is possible that progressive stress fatigue on the block, perhaps caused by temperature fluctuations, caused crack propagation, leading to the rock fall.

2011070501 Cathedral Rocks Middle Cathedral Rock RF Summer 7/5/2011 very small

According to rock climber Kait Barber (written commun., 26 August 2011): Barber and her climbing partner Ammon McNeely observed a rock fall from the north face of Middle Cathedral Rock while climbing on the southwest face of El Capitan. The rock fall originated from high on the center-right part of the north face, near the rim. Barber and McNeely estimated the fallen blocks to be about "refrigerator-sized". Impacts of the blocks on the cliff face produced a small dust cloud that dissipated within a few minutes. [No rock debris reached Southside Drive. The weather was clear and warm, with no recent precipitation.]

2011070502 Merced River Gorge El Portal Road/Big Oak Flat Road RF Summer 7/5-6/2011 small

According to Park Geologist Greg Stock: Report from the traffic control person working for the El Portal Road construction contractor of a loud rock fall sometime during the night of 5-6 July. She was controlling traffic at the junction of the El Portal/Big Oak Flat Road intersection and heard a loud rock fall from that general location lasting 20-30 seconds. Subsequent investigation of the cliffs near Pulpit Rock failed to reveal a fresh scar. It is possible that the rock fall occurred from Last Resort Cliff, where an earlier failure occurred [see ID 2011013101]. The weather was clear and mild.

2011070701 Glacier Point Ledge Trail RF Summer 7/7/2011 very small

According to Park Geologist Greg Stock: A small rock fall was reported from Glacier Point in the vicinity of the Ledge Trail. No exact source area was identified. The weather was clear and warm.

2011071201 Cathedral Rocks Middle Cathedral Rock RF Summer 7/12/2011 small

(1) According to Park Geologist Greg Stock: Numerous visitors in El Capitan Meadow witnessed a rock fall from Middle Cathedral Rock, which produced a substantial and highly visible dust cloud as the rock struck ledges along the cliff face. The rock fall originated from high on the center-right part north face, near the rim, from the same general source area as the 5 July 2011 rock fall. Comparison of photographs taken after the 5 July 2011 rock fall [see ID 2011070501] and ones taken after the 1 September 2011 rock fall [see ID 2011090101] indicate that the source area was adjacent to (immediately west of) the source area of the 5 July 2011 rock fall. The failed block consisted of a slab of rock about 10 m tall by 7 m wide at its widest point, and with an approximate thickness of 1 m, yielding an approximate volume of 45 m³. The weather was warm and clear, with no recent precipitation. Trigger possibly related to either thermal stresses or stress redistribution following the 5 July 2011 event. (2) According to rock climber Kait Barber (written commun., 26 August 2011): Barber and her climbing partner Ammon McNeely observed a rock fall from the north face of Middle Cathedral Rock while climbing on the southwest face of El Capitan. They described the fallen blocks as "school bus-sized or larger".

2011071301 Hetch Hetchy Eye in the Sky RF Summer 7/13/2011 small

According to Hetch Hetchy Law Enforcement Ranger Chris Smith (written commun., July 2011): A rock fall occurred from the cliff south of the Hetch Hetchy housing area near the dam (the cliff is locally

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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referred to as the "Eye in the Sky"). Smith reported a rock of about 10 m³ that made a loud rumbling sound and produced a small dust cloud. No rock debris reached the housing area.

2011071302 Three Brothers Rixon's Pinnacle RF Summer 7/13/2011 small

According to Park Geologist Greg Stock: Report of a rock fall from Middle Brother near Rixon's Pinnacle that produced a dust cloud. The rock fall originated from within the February 2000 rock fall.

2011071501 Tenaya Canyon n/a RF Summer 7/15/2011 small

According to Yosemite West residents John Mock and Kimberly O'Neil (written commun., 15 July 2011): Mock and O'Neil heard a rock fall somewhere in eastern Yosemite Valley or Tenaya Canyon. They were camped on Indian Ridge near North Dome and were awoken by a very loud crashing sound. They were not able to locate and exact source area in the dark but suspected a source in either eastern Yosemite Valley or Tenaya Canyon. Lack of reports from Yosemite Valley suggest that Tenaya Canyon is the more likely location.

2011081901 Union Point Chapel Wall RF Summer 8/19/2011 small

According to Park Geologist Greg Stock: Report of a medium-sized rock fall from the upper portion of the Chapel Wall. A witness at Sentinel Bridge heard several loud booming sounds and saw a small dust cloud. No debris reached Northside Drive or Valley loop trail. The weather was clear, sunny, and hot, with no recent rain. Unrecognized trigger, but possibly related to thermal stress.

2011090101 Cathedral Rocks Middle Cathedral Rock RF Summer 9/1/2011 small

According to Park Geologist Greg Stock: Stock observed a dust cloud in El Capitan Meadow at 06:30. Although the dust cloud had dissipated somewhat, it clearly originated from Middle Cathedral Rock, from just below the source areas of the 5 July and 12 July 2011 rock falls [see IDs 2011070501 and 2011071201]. Comparison of photos taken immediately after this event with ones taken on 5 July 2011 show two new source areas, one above the other. The upper source area, adjacent to (immediately west of) the source area of the 5 July 2011 rock fall, likely failed on 12 July 2011. The lower source area likely failed on 1 September 2011. This lower scar suggests failure of an exfoliation slab approximately 12 m tall and 16 m wide, with an approximate thickness of 1 m, yielding an approximate volume of 200 m³. The detachment surface of the failed slab showed prominent dark water staining but was dry when observed approximately 15 minutes after the rock fall occurred. Weather clear and mild, with no recent rain. Trigger likely related to stress redistribution following the earlier rock falls; being directly underneath the source areas of the 5 July and 12 July 2011 rock falls, the slab that failed on 1 September 2011 may have been hit and destabilized by those earlier rock falls.

2011091001 Yosemite Falls Lower Yosemite Falls RF Summer 9/10/2011 small

According to Park Geologist Greg Stock: A rock fall occurred above the Lower Yosemite Falls Trail, affecting the area in and near the Lower Falls amphitheater at the Lower Falls footbridge and viewing platform. At least 50 individual rock fragments, most about baseball-sized but some as big as basketball-sized struck the ground in the amphitheater and near the Lower Yosemite Falls Trail. One rock about basketball-sized traveled over the trail at about head-height. Despite several people in the vicinity, there were no reported injuries. Flyrock fragments were scattered over an area of approximately 1,500 m³. Several trees were damaged by rock debris impacts. The source area was located approximately 15 m north of the hand-railed viewpoint (known locally as "OMG Rock") below the Upper Yosemite Falls Trail, on the lower lip of the westward continuation (west of Lower Yosemite Falls) of the Sunnyside Bench ledge. The rock fall consisted of a single rectangular block about 3 m³ in volume that slid about 2 m down an east-dipping colluvial slope before sliding over the lip and falling down the cliff. Although the

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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ground surface was slightly wet due to recent precipitation, the colluvium was essentially dry, suggesting that sliding was not initiated by saturated conditions.

2011091101 Merced River Gorge Big Oak Flat Road RF Summer 9/11/2011 very small

According to Park Geologist Greg Stock: Park Dispatch reported scattered rocks on the Big Oak Flat Road, just up from (west of) the junction with El Portal Road. Approximately 0.2 m³ of rock debris on the road and ~1 m³ off the road. Debris was quickly cleared. The weather was heavy rain associated with a summer thunderstorm, and mild temperatures.

2011091102 Tioga Road Tamarack Flat RS Summer 9/11/2011 very small

According to Park Geologist Greg Stock: Park Dispatch reported a rock slide from a road cut on the Tioga Road, approximately 13 km east of the turnoff to Tamarack Flat Campground. The weather consisted of heavy rain associated with a summer thunderstorm, and mild temperatures; precipitation is the most probable trigger. The rock debris was quickly cleared from the road

2011091103 Indian Canyon Castle Cliffs DS Summer 9/11-12/2011 very small

According to Park Geologist Greg Stock: Sometime during the night of 11-12 September 2011, two boulders totaling 3.5 m³ rolled onto the Valley Loop Trail beneath the Castle Cliffs, north of the National Park Service maintenance yard. The boulders clearly originated from the talus slope immediately above the trail, sliding about 4 m vertically before rolling onto the trail. The trail was slightly damaged by the impact. Likely precipitation trigger following heavy rain.

2011091801 Three Brothers Rixon's Pinnacle RF Summer 9/18/2011 extremely small

According to Park Geologist Greg Stock: Rock climber George Ridgely heard a rock fall from Yellow Pines Campground, which he estimates was "bowling ball" sized, that fell from Middle Brother in the vicinity of Rixon's Pinnacle.

2011091901 Yosemite Falls Sunnyside Bench RF Summer 9/19/2011 very small

According to Park Geologist Greg Stock: Numerous reports of a rock fall north of Lower National Park Service Housing, from the vicinity of Sunnyside Bench. Valley Law Enforcement Ranger Matt Stark observed 2-3 small rocks bouncing down the cliff below Sunnyside Bench, producing a small dust cloud. The rocks left impact marks on the cliff both above and below Sunnyside Bench, just east of the triangular slab that holds the Regular Route. The rock fall either originated on the upper tree-covered ledge below Lost Arrow Spire, or from the high cliff in the vicinity of Lost Arrow Spire, but an exact source area could not be determined. The weather was clear and warm.

2011092401 Royal Arches Rhombus Wall RF Fall 9/24/2011 very small

According to Park Geologist Greg Stock: A climber on the climbing route "Serenity Crack/Sons of Yesterday" heard a small rock fall from the Rhombus Wall area. He estimated the volume to be about 1 m³. The weather was partly cloudy with mild temperatures.

2011092402 Half Dome Ahwiyah Point RF Fall 9/24/2011 small

According to Park Geologist Greg Stock: Park Dispatch reported a rock fall from the Ahwiyah Point area, with rock fall sounds lasting approximately 5 seconds. The rock fall followed intense local precipitation from an afternoon thunderstorm. Subsequent investigation did not reveal changes at the source area, indicated that the fall consisted of loose debris perched on ledges below the source.

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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2011092601 Royal Arches Royal Arches RF Fall 9/26/2011 very small

According to Park Geologist Greg Stock: Park Dispatch reported a very small rock fall from the Royal Arches area. No other information was available.

2011100101 Indian Canyon Castle Cliffs RF Fall 10/1/2011 very small

According to Park Geologist Greg Stock: Stock observed a small rock fall from the east side of the Castle Cliffs, north of the National Park Service stables. Approximately 3 m³ of rock detached from an approximately 20 m tall headwall and bounced down a gully to the talus slope below the cliff. Rock impacts produced a small, brown dust cloud. No debris reached the Valley Loop Trail. The weather was clear and mild, with direct sun on the cliff for approximately 1 hour prior to the rock fall; no recent precipitation. Possible thermal stress trigger.

2011100102 Royal Arches Royal Arches RF Fall 10/1/2011 very small

According to Paul Amstutz (written commun., 4 October 2011): Amstutz observed rock fall from the cliff north of the Ahwahnee, above the climbing route Serenity Crack at Royal Arches. He reported hearing a few loud cracks or pops and seeing a large plume of dust on the ledge above the 3rd pitch of Serenity Crack. Three climbers were on the route just left (west) of the impact, but no injuries were reported and the climbers continued with their climb.

2011100501 Glacier Point Curry Village RF Fall 10/5/2011 very small

According to James Lutz (written commun., 6 October 2011): Lutz was staying in Cabin 32 in Curry Village and heard a small rock fall from the cliff below Glacier Point. Lutz reported hearing sounds "consistent with 3 to 4 refrigerator-sized blocks [approximately 7 m³] falling from somewhere just above the Glacier Point Apron. From the sound, the rock fall appeared to be to the west of Cabin 32." [Subsequent observation failed to identify an exact source area.]

2011100901 Cathedral Rocks Middle Cathedral Rock RF Fall 10/9/2011 very small

According to Valerie Zimmer (written commun., 11 October 2011): Yosemite Institute instructor Kate McHugh witnessed a rock fall from Middle Cathedral Rock, between the Kor-Beck and the East-Buttress climbing routes, approximately 50-60 m east of the Kor-Beck route. She described the largest block as being 1 x 1 x 2 m in size, with smaller debris.

2011101101 Yosemite Falls Sunnyside Bench RF Fall 10/11/2011 very small

According to Park Geologist Greg Stock: Stock and several other residents in National Park Service Lower Housing heard a rock fall from the vicinity of Sunnyside Bench. There were several loud impacts and the sound of one tree getting crushed. Based on these sounds, the estimated volume is ~2 m³. The exact source area was not determined. The weather was clear and mild. Subsequent observation on 12 October 2011 did not reveal any fresh rock debris on or downslope of the Valley Loop Trail north of the housing area.

2011102801 Yosemite Falls Upper Yosemite Falls RF Fall 10/28/2011 small

According to Park Geologist Greg Stock: Numerous reports from park visitors in eastern Yosemite Valley of a rock fall from near Upper Yosemite Falls. Several hikers took photographs of the rock fall as it happened; these photographs clearly show the source area, impact points, and resulting dust cloud. The source area was from a point about 100 m west of, and about 30 below, the top of Upper Yosemite Falls, beneath a large rectangular overhanging block. The rock fall originated from the western tip of this overhanging block, with an initial volume of approximately 15 m³. This block detached and fell about 10 m before glancing off a ledge; this glancing impact dislodged a thin flake of about 5 m³ and

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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caused the initial block to break up into at least three pieces. The blocks then free-fell several hundred meters before hitting a large arching flake with a flat top about one-third of the way up the cliff, west of the falls. This impact fragmented the blocks further. The blocks then free-fell again to the base of the Upper Falls amphitheater, where they impacted hard onto the relatively flat-floored amphitheater, breaking into numerous small fragments. Subsequent observation revealed that at least one boulder about 1 m³ in volume disintegrated entirely into coarse sand-sized particles on impact; the sand pile remained in place for several days after the event. There were approximately eight hikers in the amphitheater that narrowly escaped injury, some by cowering against the cliff while rock debris fell in front of them. The weather was clear and mild.

2011110501 Merced River Gorge El Portal Road/Parkline DS Fall 11/5/2011 very small

According to Park Geologist Greg Stock: Park Dispatch reported two boulders on the El Portal Road below Parkline Slab. Each boulder was approximately 1.5-2 m on its longest side, for a total approximate volume of 5 m³. The boulders were resting in the westbound lane adjacent to the hillslope. An exact source area was not determined, but the boulders likely originated from the colluvial slope just above the road rather than the higher cliffs of Parkline Slab. Failure occurred approximately 36 hours after about 1.3 cm of precipitation (rain) fell in El Portal, and during cool but above-freezing temperatures.

2011110701 Merced River Gorge El Portal Road / Arch Rock RF Fall 11/7/2011 small

According to Park Geologist Greg Stock: Park Dispatch reported a large boulder on the El Portal Road between Arch Rock and Elephant Rock, approximately 1 km east of the Arch Rock Entrance Station. Several large boulders were on the road, the largest approximately 2.5 x 2.5 x 3 m. The largest boulder left several divots in the pavement. The source area was high (about 300 m) above the road in a fractured cliff band. The weather was cold (sub-freezing) following precipitation. This suggests a likely freeze/expansion trigger. The road was opened at 07:30. Point of impact on the road (UTM NAD83): 0259535 E 4175236 N.

2011111201 Tenaya Canyon Quarter Domes RF Fall 11/12/2011 small

According to National Park Service Historic Architect George Jaramillo (oral commun., November 2011): Jaramillo and two visitors heard a small rock fall from the general vicinity of Quarter Domes on the south side of Tenaya Canyon. They were hiking on the north side of the Mirror Lake Loop Trail when they heard three distinct rock falls separated in time by a few minutes. All three events were relatively small, characterized by clattering of a few individual rocks.

2011111202 Rockslides Rockslides RF Fall 11/12/2011 small

According to Greg Stock: Ernie Koflesh of the Medical Clinic heard a rock fall from the western side of the Rockslides area. He was stopped in construction traffic on Northside Drive near Valley View when he heard a very loud rumble from the cliffs to the north. He was unable to pinpoint an exact source area, but tentatively placed it at or near the Rockslides. Subsequent observation from Tunnel View failed to locate the source area. It is possible that the rock fall occurred from Last Resort Cliff, where an earlier failure occurred [see ID 2011013101]. Based on the sound of the rock fall, the volume is estimated at ~20 m³.

2011112001 El Capitan Ribbon Falls RF Fall 11/20-24/2011 small

According to Valerie Zimmer, GeoCorps Intern (written commun., 28 November 2011): Zimmer observed fresh rock debris at the base of Ribbon Falls, on the southeast side of the amphitheater 100 m from the base of the falls near Ribbon Creek. Debris "included fine crushed rock dust at several impact

ID Number	Location information	Failure type	Season	Date (mo/day/yr)	Relative size
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points and several boulders shattered into fragments no larger than 2 m on any side." Zimmer described the cumulative volume as "pickup truck to dump truck volume", or about 10-15 m³, scattered over an area of approximately 30 m x 30 m. Assuming the rock fall happened after rain and snow on 20 November (based on preservation of fine rock dust in the impact area), the event occurred sometime between 20 November and noon on 24 November. The source area was likely high in the Ribbon Falls amphitheater.

201112701 Basket Dome Basket Dome RF Fall 11/27/2011 very small

According to National Park Service Geology Intern Matteo Mantovanelli (oral commun., November 2011): A very small rock fall occurred from the north side of Tenaya Canyon below Basket Dome. He heard a single rock falling down the cliff for approximately 10 seconds. The weather was clear and sunny with no recent precipitation.

2011120001 Hetch Hetchy Wapama Falls RF Fall 12/n/a/2011 small

According to Park Geologist Greg Stock: Report from Trail crew supervisor Jose Lopez of a rock fall approximately 1 km east of Wapama Falls at the three switchbacks connecting a lower bench with a higher bench. The rock-fall source area was approximately 70 meters above the bench trail in an overhanging, already-weathered roof area with a tree nearby. The rock fall detached, impacted the cliffs near the base, and likely remobilized at least an additional 10 m³ of old rock fall debris on the loose slope. This combined debris cut through the middle of all three switchbacks on the trail, with boulders coming to rest above, on, and below the trail for a width of 3-5 meters. There were no injuries associated with the event.

2011120002 Hetch Hetchy Hetch Hetchy RF Fall 12/n/a/2011 small

Report from LE Ranger Chris Smith of a rock fall onto the controlled-access road below O'Shaughnessy Dam that leads to the Diversion Tunnel. Approximately 15 m³ of rock debris fell from beneath an overhanging roof and landed on the road, causing minor damage to the road surface. No information on local conditions was provided, so the trigger is unknown, but subsequent photos of the rock-fall source area showed that the overhang had roots from an adjacent Ponderosa Pine sticking out underneath it, and these roots may have contributed to the failure.

2011121001 Sentinel Rock Sentinel Creek DS Fall 12/10/2011 small

According to Park Geologist Greg Stock: Report from two Yosemite Institute instructors, who were camped on the summit of El Capitan, of a rock fall (most likely a debris slide) in the vicinity of Sentinel Creek. They heard a loud rumble from near Sentinel Rock and barely perceived a dust cloud in the darkness. Subsequent observation of the debris slide scar along upper Sentinel Creek showed fresh surfaces, suggesting that it was source. Weather clear, mild, with no recent precipitation.

2011123101 Half Dome Ahwiyah Point RF Winter 12/31/2011 small

According to National Park Service Historian Shawn Lingo (oral commun., December 2011): A rock fall occurred from the Mirror Lake area. Lingo was on the talus slope by the upper Indian Cave entrance and heard three loud booms coming from Tenaya Canyon. Looking in that direction he saw a dust cloud near Half Dome. An exact source area not determined, but it possibly derived from Ahwiyah Point. The weather was clear and cool with no recent precipitation.