

Grove Karl Gilbert's Photographs as Evidence in Geology: Documenting the 1906 San Francisco Earthquake. MICHELE L. ALDRICH,¹ ALAN E. LEVITON,² and KARREN ELSBERND³ (¹California Academy of Sciences [24 Elm Street, Hatfield, MA 01038], E-mail: maldrich@smith.edu; ², ³California Academy of Sciences, 875 Howard Street, San Francisco CA 94103, E-mail: aleviton@calacademy.org, keelsbernd@calacademy.org).

(SLIDE 1) Serendipity often plays a larger than expected role in most scholarly pursuits, and this paper owes its existence to serendipity. It came about as a result of our study of a collection of original prints of Grove Karl Gilbert photographs, many taken in April and May 1906 documenting the aftermath of the San Francisco earthquake and fire of 18-19 April, in the Archives of the California Academy of Sciences. At the time, we were preparing a paper to celebrate the 100th anniversary of the event, which had resulted in the near total destruction of our Academy. Thus, three questions arose (SLIDE 2), and these we will address in this presentation:

- Gilbert's 1906 earthquake studies
- Gilbert's education as a photographer
- Gilbert's use of images in geological reports

Now allow your mind to imagine it is April 1906. Grove Karl Gilbert was living in Berkeley, California. He was there on assignment from the US Geological Survey to study the effects of hydraulic mining (SLIDE 3) on the San Francisco Bay and estuary, a political hot potato in California. At the time Gilbert was 62 (SLIDE 4). But Gilbert had been interested in earthquakes for a very long time, dating back to 1872 when his interest was piqued by observations he had made in the Great Basin while on the Wheeler Survey. By 1883, Gilbert wrote an article that was published in the *Salt Lake City Tribune* in which he clearly articulated the concept that vertical displacement along faults was responsible for mountain building in the Great Basin and in the vicinity of Salt Lake City, and he warned residents of the city that movement along the fault bordering the Wasatch Front could and would generate earthquakes, for which they should be prepared. Interestingly, up to this point, and indeed as late as April 1906, Gilbert had never experienced an earthquake himself.

Gilbert's first very brief paper following the earthquake in San Francisco appeared on 28 April in the *San Francisco Mining and Scientific Press*. In it, he still emphasized mountain building through vertical uplift along faults, which caused earthquakes, and which he distinguished from volcanic activity. The relation between movement along faults and mountain building dates back to his earlier experiences with the Wheeler Survey in the Great Basin. But, as well shall see, he was quick to modify his thoughts as they relate to movement along faults.

But, returning to 18 April, at first light, Gilbert, the geologist and Gilbert the photographer, emerged to record the events of the quake. He took interest in all aspects of what had happened, the dramatic (SLIDE 5), the landscape, and damage to buildings (SLIDE 6), the latter because he reasoned it would give some indication of the ground

movement (he reasoned that transverse waves moving through unconsolidated sand and soils would cause maximum damage to buildings).

Immediately following the devastating events of the 18th, two studies were initiated, one by the U.S. Geological Survey, the second by California, which set up a commission, the State Earthquake Investigation Commission. Grove Karl Gilbert was appointed to both.

Gilbert's first expanded contribution appeared in August 1906 in an article published in *Popular Science Monthly*. This was scarcely four months after the earthquake. In this article, Gilbert included a map (SLIDE 7) showing the trace of the San Andreas Fault, which had been mapped more than a decade earlier, in 1893, by Andrew Lawson.

Chance favors the prepared mind, and first hand observations by Gilbert in Marin County, such as the horizontal offset of the fence (SLIDE 8) were to lead him to change his mind and recognize that horizontal as well as vertical movements along faults can generate earthquakes of great magnitude as well as dislocations, both horizontal as well as vertical.

As mentioned earlier, Gilbert was much interested in damage to buildings (SLIDE 9) and what that meant with respect to ground movement.

In the USGS report, published in 1907, Gilbert wrote the 14-page introduction, provided no fewer than 11 of the 100 halftone images, and he collaborated with others on the balance of the 125-page report. Gilbert's photos were mostly of landscape (SLIDE 10), but buildings were not neglected (SLIDE 11).

In 1908, the State's Earthquake Commission issued its massive report. This State-sponsored, Carnegie Institution-funded document was edited by Andrew Lawson (SLIDE 12) of the University of California and is most often referred to as the "Lawson Report." Gilbert's seminal role was not only his investigation of the fault in Marin County, especially in the vicinity of Tomales Bay, but also his many photographs (SLIDE 13). Gilbert's fieldwork and photography in the Bolinas-Pt. Reyes region were particularly instructive. The 58 pictures he contributed to the Lawson report reveal not only a diversity of earthquake-caused changes (SLIDE 14) but they document the complexity the fault (SLIDE 15) (SLIDE16) (SLIDE 17) (SLIDE 18) and its movement (SLIDE 19), all this in lieu of seismographs. Seismographic data were available for the 1906 event, but they were too few to permit many generalizations.

At this point, we want to ask, "What happened to Gilbert's original photographs?" We know that the USGS Photo Library has many of them, as shown in the following table (SLIDE 20), which summarizes the Gilbert photos dating from 1870 that have been mounted on the USGS website. The list is not exhaustive by any means.

But there is also a hidden treasure trove of original Gilbert prints in the Archives of the California Academy of Sciences. These are included among the papers of Academy botanist Alice Eastwood (1860-1953).

Grove Carl Gilbert met Alice Eastwood probably at outings of the Sierra Club, of which they were both members, sometime before 1906. Whatever the case, in April or early May of 1906, thus shortly after the earthquake, the two traveled together to Tomales Bay, perhaps by horseback, which was something they were to do on subsequent travels (SLIDE 21). Again, Gilbert, the geologist-photographer was to document the changes in the landscape, as seen in this photograph (SLIDE 22) showing Alice Eastwood standing at the edge of the rift. We will return to this shortly.

Let us flash back for a moment to ask the question, “Where did Gilbert get his tutelage as a photographer?” (SLIDE 23) Gilbert, in 1870, worked for John Strong Newberry (SLIDE 24) on the Ohio Survey (SLIDE 25). It was Newberry who recommended Gilbert to Lieutenant George Wheeler, which resulted in Gilbert joining the Wheeler Survey (SLIDE 26) in 1871. On this survey, Gilbert came under the influence of survey photographer Timothy O’Sullivan (SLIDE 27) from whom he learned the basics of wet-plate photography. O’Sullivan had a mentor himself, famed Civil War photographer Matthew Brady (SLIDE 28). The earliest photo of which we know that shows Gilbert in the field is one taken by O’Sullivan sometime between 1871 and 1873 (SLIDE 29). O’Sullivan’s photographs are among the finest of its genre of the West (SLIDE 30).

In 1875, Gilbert joined the Powell Survey where he worked with John Hillers (SLIDE 31) whose dramatic use of contrast (SLIDE 32) was a lesson that would serve Gilbert well in years to come.

But times change and the technology of photography changed too: wet plate gave way to dry plate and then to film. As a result, no longer did the field geologist require a photographer to accompany him. The geologist became his own photographer. But the change did not come all at once, nor did it have an immediate impact on what appeared in publications. Thus, although by 1883 we see more Gilbert photos showing up, for example the columnar structures recorded by Gilbert in the Blue Ridge of Virginia (SLIDE 33), this and his later photos, such as 1891 photograph of Meteor Crater in Arizona (SLIDE 34), his 1895 photo of Niagara Falls, New York (SLIDE 35), and of an iceberg in Muir Inlet, Glacier Bay, Alaska in 1899 (SLIDE 36) were used to document geological details. Clearly, as time progressed, Gilbert’s photographs become increasingly useful and even dramatic. Gilbert, the geologist, and Gilbert, the photographer, had matured.

(SLIDE 37) One question often leads to another. In this case, we asked, how did Gilbert use images in his geological reports? In his classic 1877 publication on the Henry Mountains (SLIDE 38), Gilbert used drawings and engravings, the former usually based on sketches he and others had made in the field that were then redone by artists for publication, such as Waterpocket Canyon (SLIDE 39) and Mount Holmes (SLIDE 40). In

his Bonneville monograph of 1891 (SLIDE 41), Gilbert continued to use engravings, such as the panorama (SLIDE 42) by USGS artist William Holmes (SLIDE 43). Holmes had worked for both Hayden and Powell, and Gilbert put his extraordinary talents to good use. But Gilbert also included in engravings made from photographs others had taken, such as C.R. Savage's Sheep Rock (SLIDE 44) on the Great Salt Lake.

In 1898, Gilbert joined the Harriman expedition to Alaska. His report on glaciers and glaciation (SLIDE 45) included many illustrations that were based on photos he took, such as that of the Muir Glacier (SLIDE 46). But the Harriman reports used engravings done from the original photos, such as the Muir Glacier (SLIDE 47), or heliotype prints. Gilbert used the latter to good effect, documenting changes in landscape, or rather glacierscape, over time. Thus, in his plate illustrating the Turner Glacier (SLIDE 48), he compares the glacier based on photos, one taken by him in 1899, and the other by I.C. Russell in 1891. Gilbert's image had to be severely cropped for the comparison; the original (SLIDE 49) is by far a more comprehensive and impressive view of the glacier and surroundings. What is also important, here, for the first time to our knowledge, Gilbert uses photographs to document change over time, before and after, something he was to do in his 1908 report on the San Francisco earthquake in which he showed the effect of fault slippage on Bailey's Pier at Inverness (see SLIDE 14).

For some reason, and we do not know why, there are no halftones in the Harriman report. Thus, Gilbert's use of halftones depended on the publisher. Although he used halftones in several earlier memorials, his first use in geology to the best of our knowledge is to be found in the Geological Society of America's *Bulletin* of 1899 (SLIDE 50).

In summary, Grove Karl Gilbert learned design and composition from both Timothy O'Sullivan and John Hillers. He used photographs for scientific documentation. He readily adapted to major changes that took place during his lifetime in photographic technology, wet plate to dry plate, to film, drawings to engravings, to heliotypes, to halftones. Gilbert took full advantage of each step having lived through all phases of this technological revolution.

And, as for the California Academy of Sciences, in 1917 Gilbert and Alice Eastwood (SLIDE 51) had decided to marry after a courtship that lasted well over a decade. In early 1918, on his way to California, Gilbert stopped off to visit his sister in Michigan. There he died, but the Gilbert legacy at the California Academy of Sciences was kept alive in the images he had left with Alice Eastwood during their years together. This legacy was lost from sight for nearly 100 years until the photographs were rediscovered by Academy staff barely one year ago.

(SLIDE 52) For assistance in preparing this presentation, we wish to acknowledge with grateful thanks Mark Aldrich (Smith College), Larry Currie (Librarian, California Academy of Sciences), J. Thomas Dutro, Jr. (USGS [ret.]), and Tommie Ann Gard (USGS Librarian, Denver). We also acknowledge the courtesy of the staff at Smithsonian Institution Archives for allowing us to access to the George P. Merrill photo archives.

References

- California State Earthquake Investigation Commission. 1908–1910. The California Earthquake of April 18, 1906. Report of the State Earthquake Investigation Commission. Vol. 1 (1908), pt. 1, pp. xviii + 254, 54 figs., pls. 1–98; Vol. 1 (1908), pt. 2: pp. 255–451, pls. 99–145; Vol. 2 (1910), viii + 192 pp. Carnegie Institution of Washington, Washington, D.C., USA.
- Dean, Dennis R. 1993. The San Francisco earthquake of 1906. *Annals of Science* 50:501–521, figs. 1–8.
- Fradkin, Philip L. 2005. *The Great Earthquake and Firestorms of 1906. How San Francisco Destroyed Itself.* University of California Press, Berkeley and Los Angeles, California, USA. xvii + 418 pp.
- Geschwind, Carl-Henry. 2001. *California Earthquakes: Science, Risk & the Politics of Hazard Mitigation.* Johns Hopkins University Press, Baltimore, Maryland, USA. x + 337 pp., map.
- Gilbert, Grove Karl. 1877. Report on the Geology of the Henry Mountains. United States Geographical and Geological Survey of Rocky Mountain Region. US Government Printing Office, Washington, D.C., USA. 160 pp.
- Gilbert, Grove Karl. 1883. [Letter] on a theory of the earthquakes of the Great Basin, with a practical application. *Salt Lake City Tribune*, Sept. 20, 1883. [Reprinted in 1884 in *American Journal of Science*, ser. 3, 27:49–53.].
- Gilbert, Grove Karl. 1890. *Lake Bonneville.* United States Geological Survey Monograph, vol. 1. US Government Printing Office, Washington, D.C., USA. 438 pp.
- Gilbert, Grove Karl. 1899. Dislocation at Thirtymile Point, New York. *Bulletin of the Geological Society of America* 10:131–134, pl. 12.
- Gilbert, Grove Karl. 1904. *Glaciers and Glaciation of Alaska.* Doubleday, New York, New York, USA. 231 pp.
- Gilbert, Grove Karl. 1906a. The cause and nature of earthquakes. *Mining and Scientific Press* 92(17):272–273.
- Gilbert, Grove Karl. 1906b. The investigation of the San Francisco earthquake. *The Popular Science Monthly* 69(2):97–117, figs. 1–14.
- Gilbert, Grove Karl. 1907a. The investigation of the California earthquake. Pages 213–256 and 11 photos. in David Starr Jordan, ed., *The California Earthquake of 1906.* A.M. Robertson, San Francisco, California, USA. 371 pp.
- Gilbert, Grove Karl. 1907b. The earthquake as a natural phenomenon. Pages 1–13 and 11 photos in *The San Francisco Earthquake and Fire of April 18, 1906, and Their Effects on Structures and Structural Materials.* U.S Geological Survey Bulletin 324, Series R, Structural Materials, 1. U.S. Government Printing Office, Washington, D.C., USA.
- Gilbert, Grove Karl. 1908a. [The San Andreas Rift as a geomorphic feature: Bodega Head to Bolinas Bay, [including] general note, characteristics of the rift.] Pages 30–35 in Andrew Cowper Lawson, ed., *The California Earthquake of April 18, 1906.* Report of the State Earthquake Investigation Commission, vol. 1. California: State Earthquake Investigation Commission. Carnegie Institution of

- Washington publ. 87. Carnegie Institution of Washington, Washington, D.C., USA.
- Gilbert, Grove Karl. 1908b. The earth movement on the fault of April 18, 1906: Tomales Bay to Bolinas Lagoon. Pages 66–85, 185, 191–197, 214–215, 367–368 in Andrew Cowper Lawson, ed., *The California Earthquake of April 18, 1906*. Report of the State Earthquake Investigation Commission, vol. 1. California: State Earthquake Investigation Commission. Carnegie Institution of Washington publ. 87. Carnegie Institution of Washington, Washington, D.C., USA.
- Gilbert, Grove Karl. 1909a. Earthquake forecasts. *Science*, n.s., 29(734):121–138.
- Gilbert, Grove Karl. 1909b. The California earthquake of 1906. *American Journal of Science*, ser. 4, 27(January):48–52.
- Gilbert, Grove Karl. 1914. *The Transportation of Debris by Running Water*. U.S. Geological Survey Professional Paper 86. U.S. Geological Survey, Government Printing Office, Washington, D.C., USA. 263 pp.
- Gilbert, Grove Karl. 1917. *Hydraulic-mining Debris in the Sierra Nevada*. U.S. Geological Survey Professional Paper 105. U.S. Geological Survey, Government Printing Office, Washington, D.C., USA. 154 pp.
- Humphrey, Richard Lewis. 1907. The effects of the earthquake and fire on various structures and structural materials. Pages 14–61 and 67 photos in *The San Francisco Earthquake and Fire of April 18, 1906, and Their Effects on Structures and Structural Materials*. U.S. Geological Survey Bulletin 324, Series R, Structural Materials, 1. U.S. Government Printing Office, Washington, D.C., USA.
- Hunt, Charles B. 1988. *Geology of the Henry Mountains, Utah, as recorded in the notebooks of G.K. Gilbert, 1875–76*. Geological Society of America, Memoir 167. Geological Society of America, Boulder, Colorado, USA. 229 pp.
- Jordan, David Starr, ed. *The California Earthquake of 1906*. A.M. Robertson, San Francisco, California, USA. 371 pp., illus.
- Lawson, Andrew Cowper, ed. 1908–1910. *The California Earthquake of April 18, 1906*. Report of the State Earthquake Investigation Commission, in 2 vols. plus Atlas. California: State Earthquake Investigation Commission. Carnegie Institution of Washington publ. 87. Carnegie Institution of Washington, Washington, D.C., USA.
- Leviton, Alan E., Michele L. Aldrich, and Karren Elsbernd. 2006. The California Academy of Sciences, Grove Karl Gilbert, and Photographs of the 1906 Earthquake, Mostly from the Archives of the Academy. *Proceedings of the California Academy of Sciences*, ser. 4, 57(1):1–34, figs. 1–37.
- Niemi, Tina M., N. Timothy Hall, and Alexander Dahne. 2006. The 1906 earthquake rupture trace of the San Andreas fault north of San Francisco, with stops at points of geotechnical interest.. Pages 157–176 in C.S. Prentice, J.G. Scotchmoor, E.M. Moores, and J.P. Kiland, eds., *2006 San Francisco Earthquake: Centennial Field Guides, Field Guide 7*. Geological Society of America, Boulder, Colorado, USA.
- Pyne, Stephen J. 1980. *Grove Karl Gilbert, a Great Engine of Research*. University of Texas Press, Austin, Texas, USA. xiv + 306 pp., illus., maps.

- Pyne, Stephen J. 1999. Grove Karl Gilbert. Pages 4–5 in J. Garraty and M.C. Carnes., eds., *American National Biography*, vol. 9. Oxford University Press, New York, New York, USA.
- Rodda, Peter U., and Alan E. Leviton. 1983. Nineteenth century earthquake investigations in California. *Earth Sciences History* 2(1):48–56, figs. 1–10.
- Sandweiss, Martha A. 2002. *Print the Legend: Photography and the American West*. Yale University Press, New Haven, Connecticut, USA. xiii + 402 pp.
- Sewell, John S. 1907. The effects of the earthquake and fire on buildings, engineering structures, and structural materials. Pages 62–130 and 15 photos in *The San Francisco Earthquake and Fire of April 18, 1906, and Their Effects on Structures and Structural Materials*. U.S. Geological Survey Bulletin 324, Series R, Structural Materials, 1. U.S. Government Printing Office, Washington, D.C., USA.
- Soulé, Frank. 1907. The earthquake and fire and their effects on structural steel and steel-frame buildings. Pages 131–158 and 8 photos in *The San Francisco Earthquake and Fire of April 18, 1906, and Their Effects on Structures and Structural Materials*. U.S. Geological Survey Bulletin 324, Series R, Structural Materials, 1. U.S. Government Printing Office, Washington, D.C., USA.
- US Geological Survey Photographic Archive Website. 2006 (August). <<http://libraryphoto.cr.usgs.gov/>>
- Wallace, Robert E. 1980. G.K. Gilbert's studies of faults, scarps, and earthquakes. Pages 35-44, figs. 1–14 in Ellis L. Yochelson, ed., *The Scientific Ideas of G.K. Gilbert: An Assessment on the Occasion of the Centennial of the United States Geological Survey (1879–1979)*. Geological Society of America, Special Paper 183. Geological Society of America, Boulder, Colorado, USA.

Grove Karl Gilbert's Photographs as Evidence in Geology:

Documenting the 1906 San Francisco Earthquake

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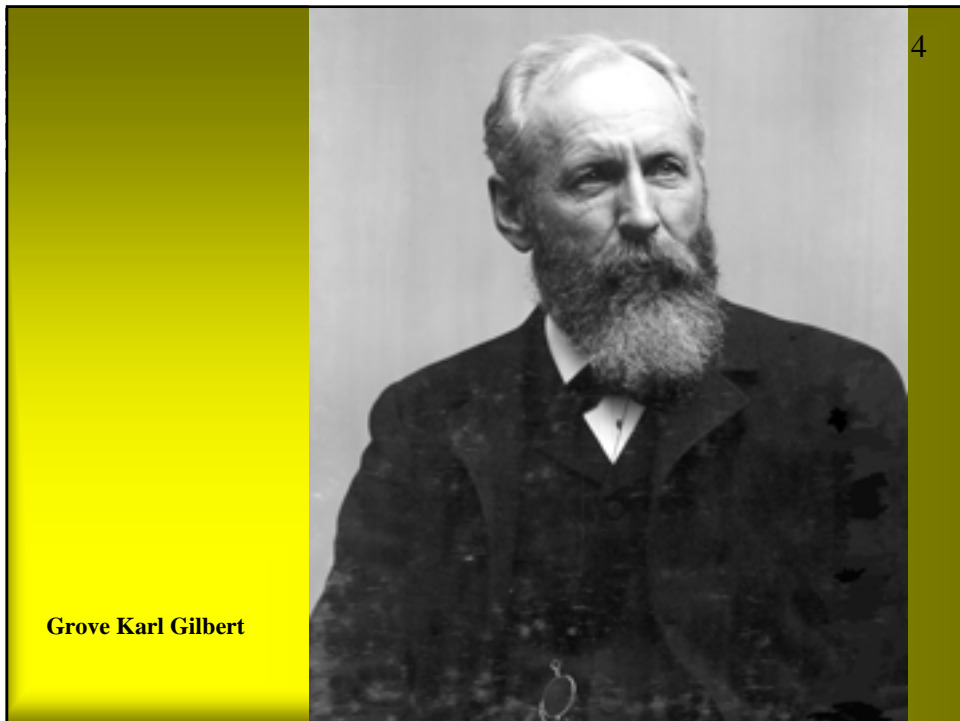
Gilbert's 1906 Earthquake Studies

Gilbert's Education as a Photographer

Gilbert's Use of Images in Geology Reports



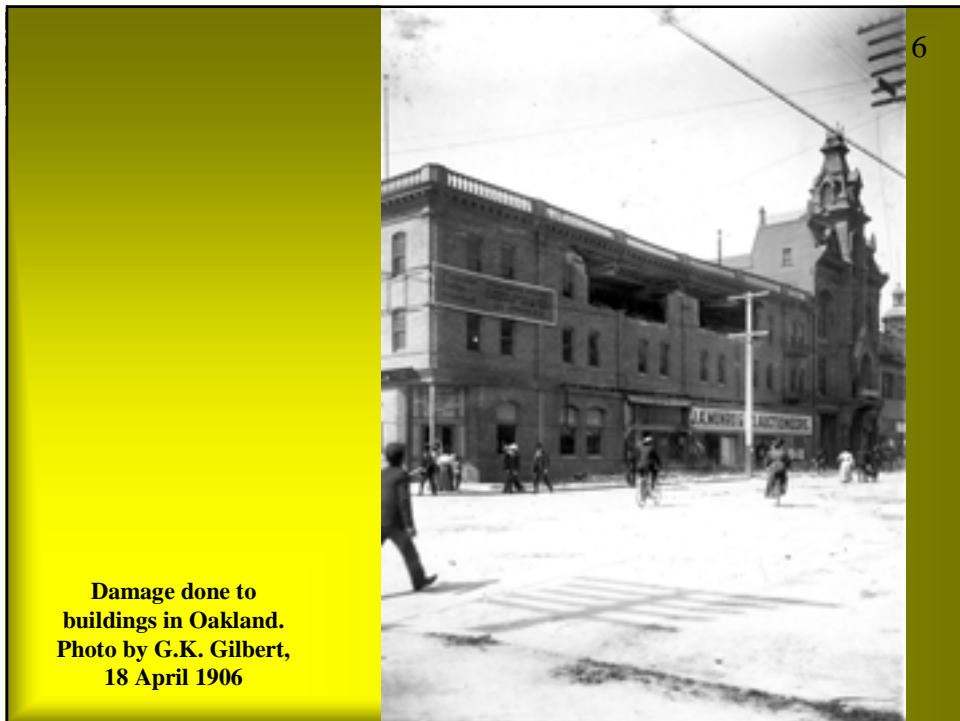
Hydraulic mining at the Esperance Mine, French Corral, California



Grove Karl Gilbert



Fire cloud over San Francisco. Photo taken from somewhere in the East Bay by G.K. Gilbert.



Damage done to buildings in Oakland. Photo by G.K. Gilbert, 18 April 1906



School-house at Point Reyes Station, near Inverness, shifted horizontally two and one-half feet by the earthquake. Photo by G.K. Gilbert.

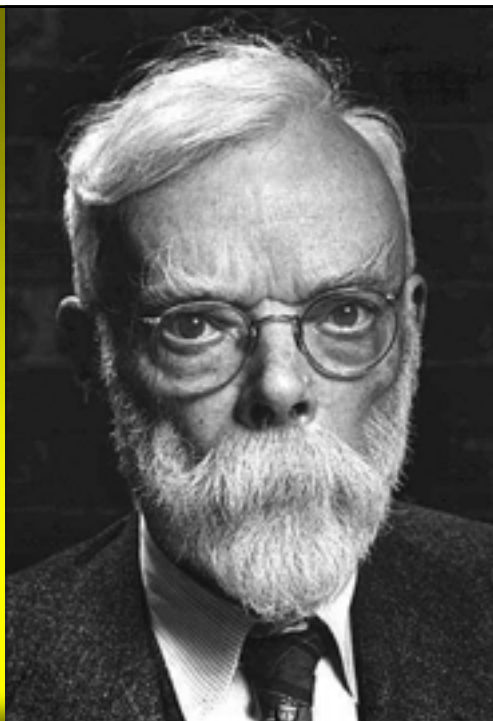


Fault trace two miles north of the Skinner Ranch at Olema. View is north. Illustrates ridge phase.

Gutted interior of Academy museum building after earthquake and fire. Note that steel-reinforced floors are intact.



Andrew Cowper Lawson



Photographs in the Lawson Report
(1908)

<i>Photographer</i>	<i>Number photos</i>	<i>Percent photos</i>
G.K. Gilbert	58	17.4
A.C. Lawson	40	12.0
F.E. Matthes	36	10.8
H.W. Fairbanks	29	8.7
J.C. Branner	23	6.9
R.S. Holway	21	6.3
H.O. Wood	20	6.0
A.S. Eakle	10	3.0
R.L. Humphry	6	1.8
Other, signed	48	14.4
Unattributed	43	12.9
Total	334	100.2*

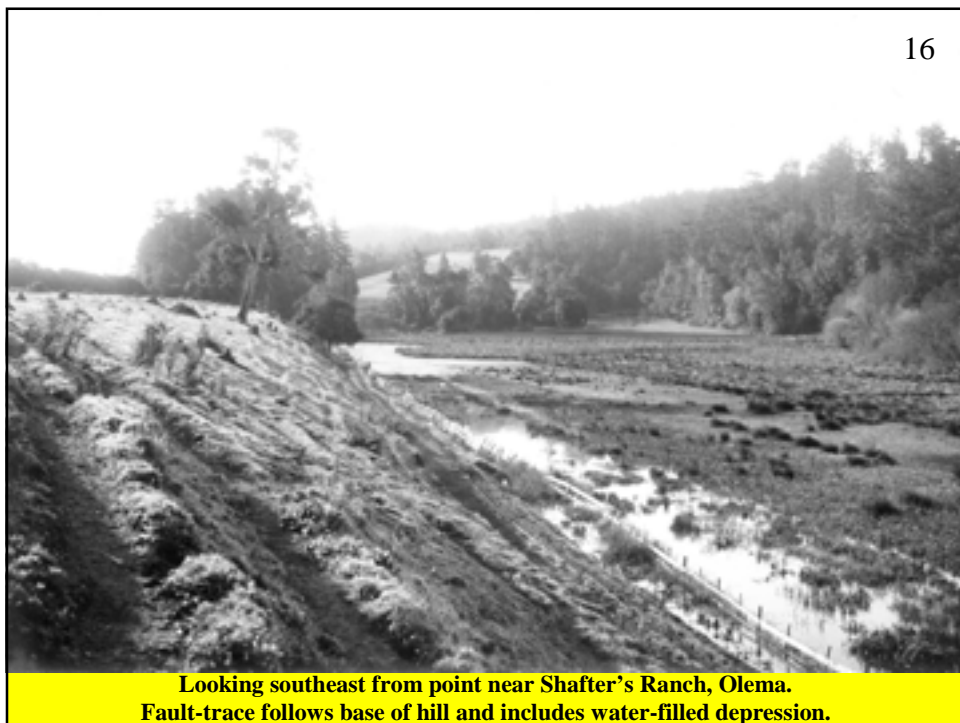
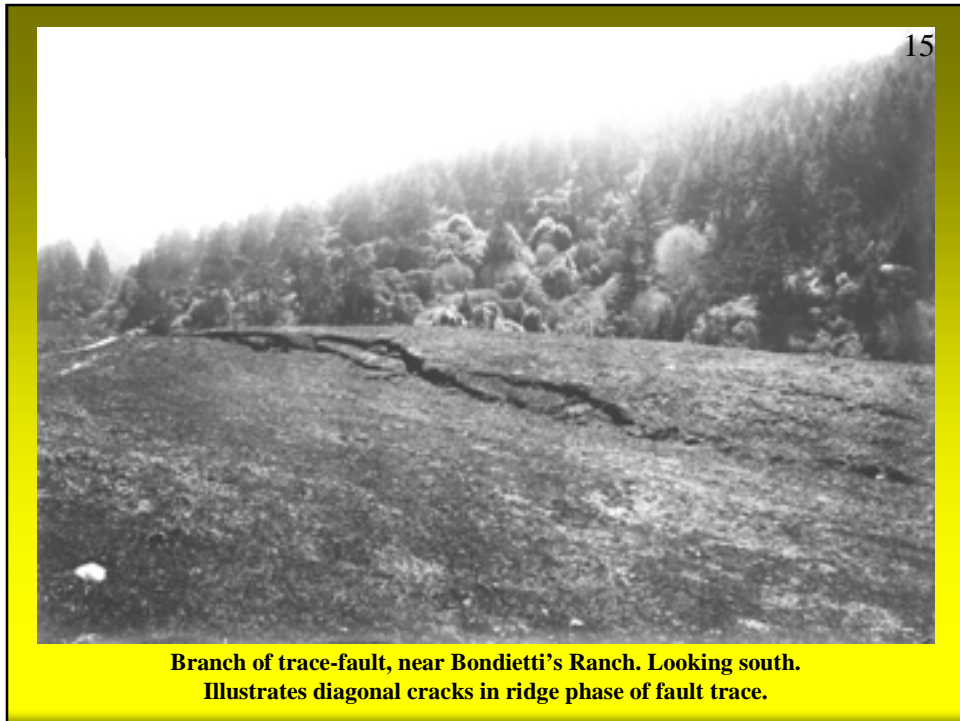
* Rounding error



(Above) Pre-earthquake photo of Bailey's Pier, Inverness. Photo by Martha P. Schreiber; published by GK Gilbert in Lawson (1908).



(Right) Post-earthquake photo of Bailey's Pier, Inverness, by GK Gilbert. Originally straight; shifted and much broken. In subsequent repairs, curvature caused by the earthquake was retained.



**Fault trace and sag ponds
south of Shafter**



**San Francisco, California,
Earthquake April 18, 1906.
Secondary cracks on the shore
of Bolinas Lagoon.**





Buckling caused by earth flow,
Howard Street, San Francisco,
18 April 1906
USGS Photo Archives, Denver

Gilbert's Photographs on USGS Photo Archive Website

- 1870: Ohio
- 1883: Virginia (Blue Ridge)
- 1885: Washington, D.C. deltas and terraces
- 1889: New York State lake shores
- 1891: Meteor Crater (Arizona)
- 1895, 1902: Niagara Falls
- 1899: Harriman Expedition, mainly Alaska
- 1901: Wasatch fault scarps and other Bonneville features
- 1903: Sierra Nevada (California), including Yosemite
- 1905–1909: Hydraulic mining (California)
- 1906–1908: Earthquake (California)

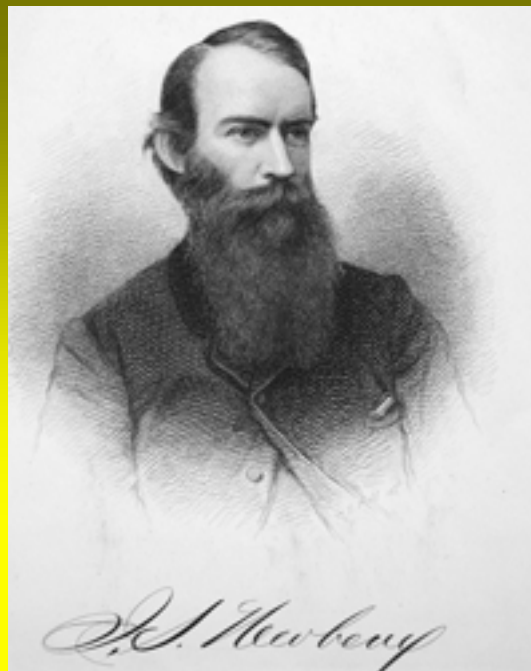


Grove Karl Gilbert and Alice Eastwood in Yosemite, 1908



On the edge of rift, Marin Co.

Gilbert's Education as a Photographer



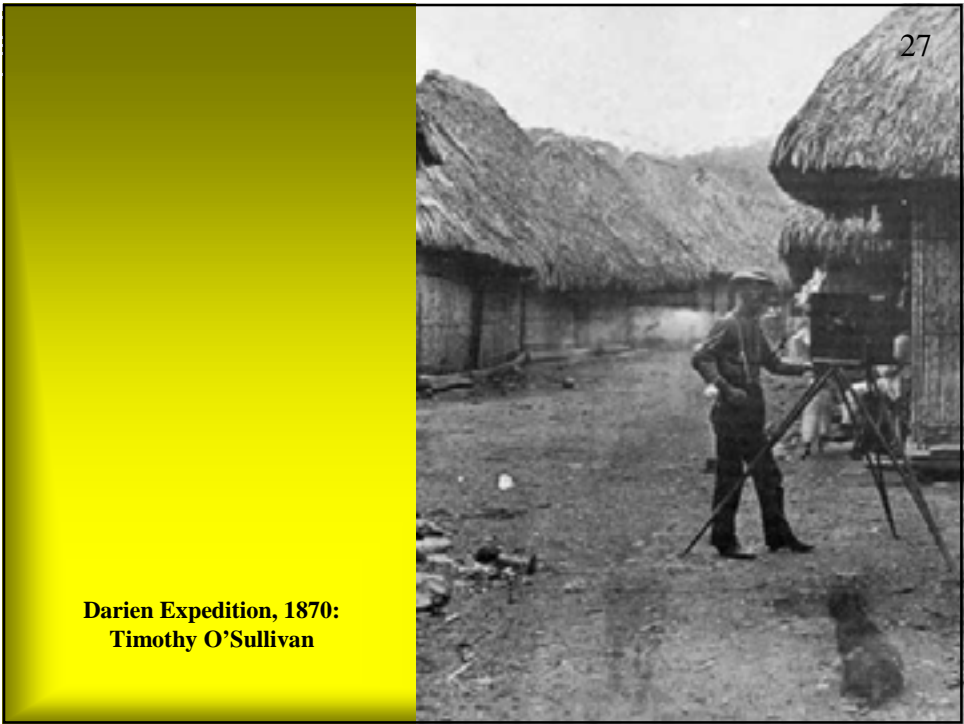
John Strong Newberry
Smithsonian Archives



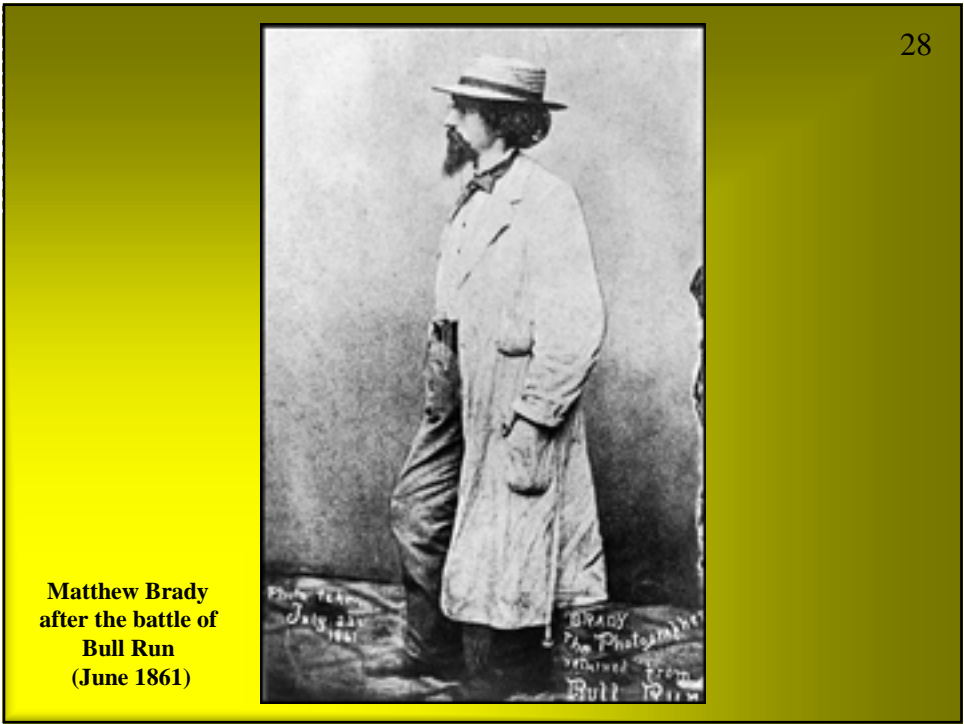
Ohio. Delta of recent formation at the edge of an artificial pool near Berea. Photo (USGS Photo Archives) attributed to GK Gilbert circa (?) 1870 but at least date is unlikely.



Wheeler Survey
(undated photo)
Smithsonian
Archives



**Darien Expedition, 1870:
Timothy O'Sullivan**



**Matthew Brady
after the battle of
Bull Run
(June 1861)**



Gilbert in the field, 1871 or 1873
Photo by Timothy O'Sullivan



T. O. O'Sullivan, 1873
BLACK CAÑON COLORADO RIVER, LOOKING DOWN NEAR CAMP 7

Black Cañon of the Colorado, by Timothy O'Sullivan

31

**John Hillers on the
Aquarius Plateau, Utah,
in 1875 (Powell Survey).
Photo by either
Thompson or Gilbert.**



32

**Grand Canyon of the
Colorado River at the foot of
the Toroweap. Arizona; n.d.
Photo by John Hillers.**





Virginia. Columnar structure in the Blue Ridge Mountains
at Stony Man Camp. Circa 1883.



Meteor Crater, Arizona. Across the crater, viewed from the south. 1891.



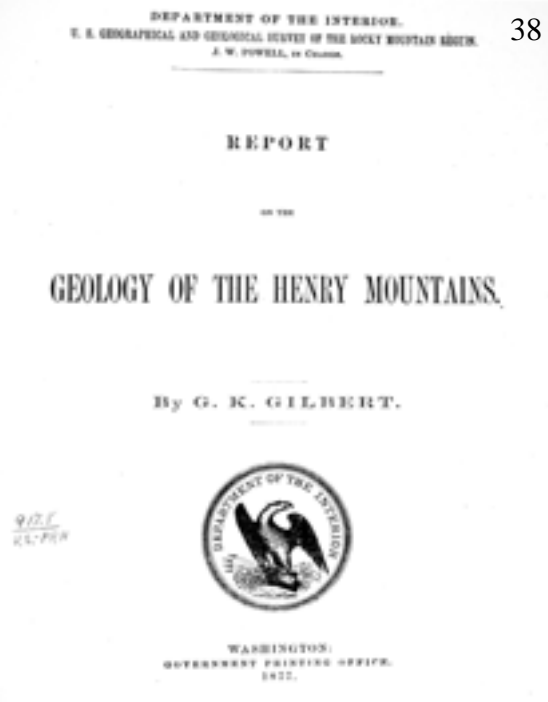
Niagara Falls, New York and Canada. American Falls, viewed from Goat Island. The camera was placed as nearly as possible in the position occupied by Captain Basal Hall when he made his camera lucida sketch in 1828. Photo by GK Gilbert, 1895.

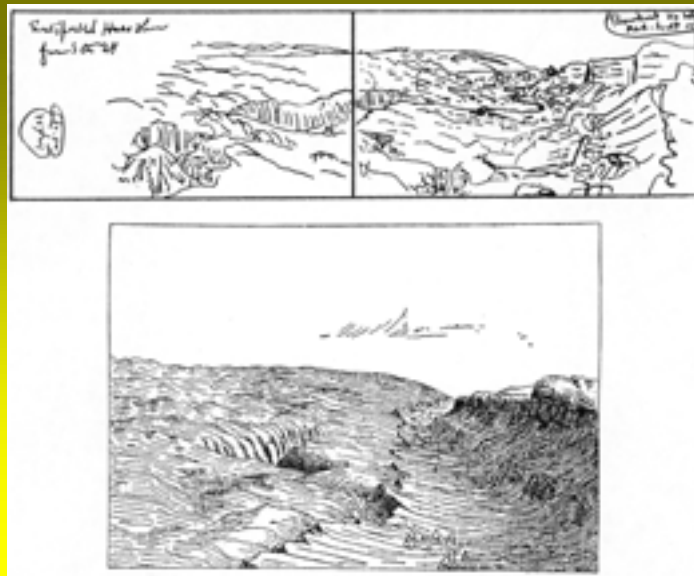


Harriman expedition. Iceberg in Muir Inlet, Glacier Bay, Southeastern Alaska. 1899

Gilbert's Use of Images in Geology Reports

**GK Gilbert
(1877)**
*Geology of the
Henry Mountains*
Title page



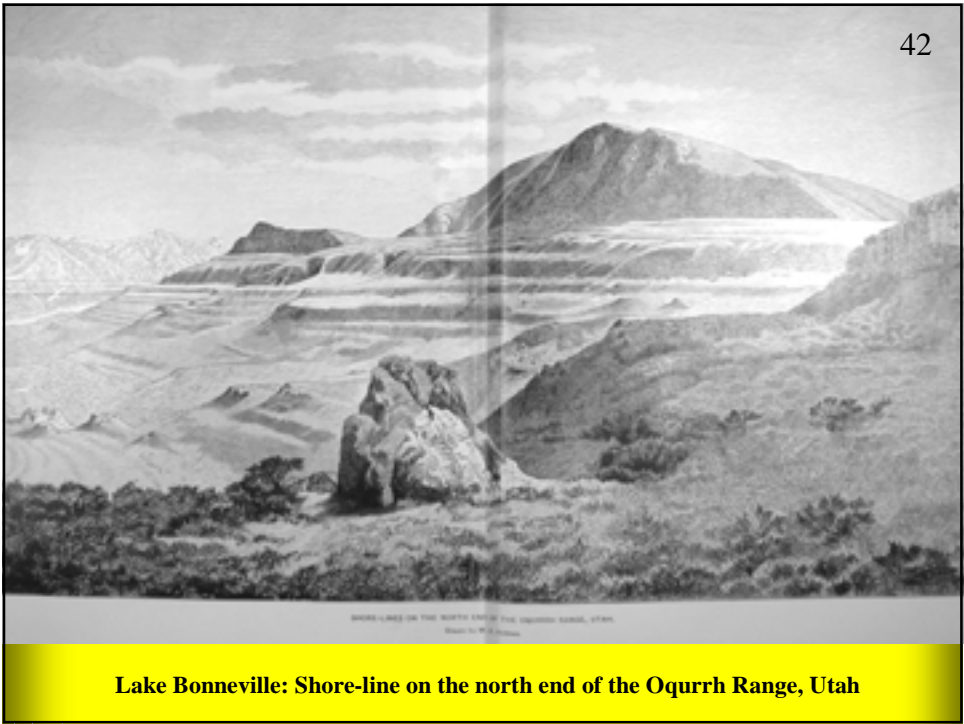
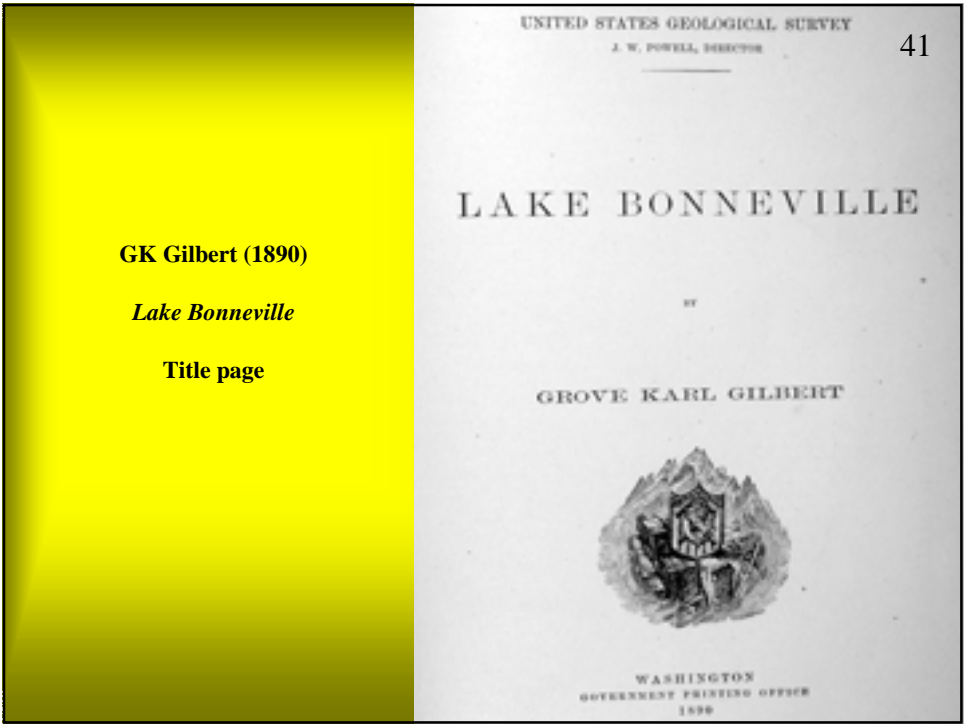


Waterpocket Canyon as drawn in Gilbert's notebook (above) and as retouched by an artist and published by Gilbert in his *Henry Mountains* monograph (1877) as Figure 68. (From Hunt 1988.)



FIG. 16.—Mount Holmes, from the north.

Henry Mountains: Mount Holmes, from the north

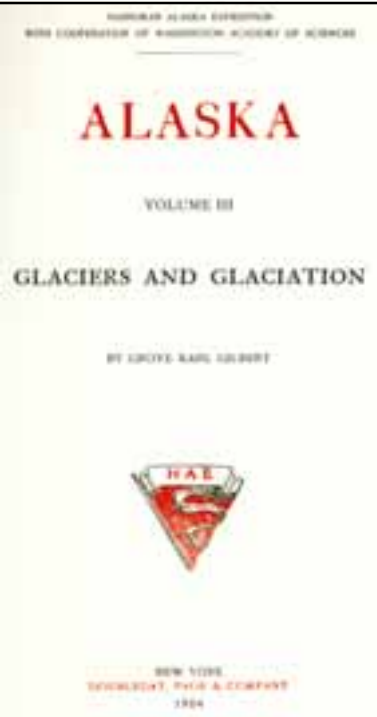


William H. Holmes
Smithsonian Archives



**Sheep Rock, a
Sea-Cliff on the
shore of Great
Salt Lake. From a
photograph by
C.R. Savage.**





Harriman Alaska Expedition
Volume III, *Glaciers*
Grove Karl Gilbert



Harriman Expedition: Muir Glacier



FIG. 9. MUIR GLACIER.

Photographed June 9, 1899, from point on mountain spur at the east, a little lower than point *E*, fig. 10.

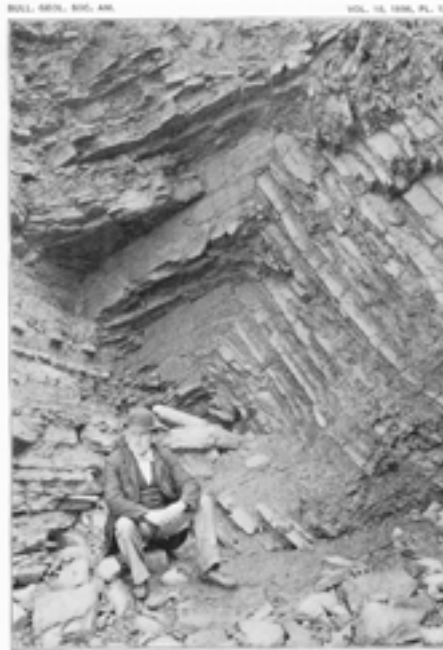
Harriman Expedition: Muir Glacier (image as published in Gilbert (1904))



Harriman Expedition: Turner Glacier. Helotype print of I.C. Russell photo taken in 1891 (above) and G.K. Gilbert's taken in 1899 (below).



Harriman Expedition: Turner Glacier in 1899 (GK Gilbert Photograph)



Gilbert's first use of halftones.
GSA Bull. 10 (1899),
Dislocation at Thirtymile
Point, New York, pl. 12.

ANTICLINE AT THIRTYMILE POINT, NEW YORK
Portion of level split-bed block shows at left of anticline. Lower part of unstratified bed shows in upper right-hand corner.

Alice Eastwood in
Yosemite (1908)



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Tommie Ann Gard, USGS Library (Denver)
Staff of Smithsonian Institution Archives