Geologic Hazards Photos
User's Manual

by

Patricia A. Lockridge
Stewart D. Racey
Susan J. McLean

September 1997

UNITED STATES DEPARTMENT OF COMMERCE
William M. Daley, Secretary

National Oceanic and Atmospheric Administration
D. James Baker, Administrator

NATIONAL GEOPHYSICAL DATA CENTER
Michael S. Loughridge, Director

Disclaimer

While every effort has been made to ensure that these data are accurate and reliable within the limits of the current state of the art, NOAA cannot assume liability for any damages caused by any inaccuracies in the data or as a result of the failure of the data to function on a particular system. NOAA makes no warranty, expressed or implied, nor does the fact of distribution constitute such a warranty.

The user must be cautious when using these data and computer programs. None of the data represented here are perfect. As in many complex scientific endeavors, errors can be expected.

Trademark Acknowledgments

In this documentation for the **Geologic Hazards Photos**, trademarked commercial products and companies are named. Mention of a commercial company or product does not imply endorsement by NOAA or the Department of Commerce. Use for publicity or advertising purposes of information from this publication concerning proprietary products or the tests of such products is not authorized.

Throughout the publication, rather than put a trademark symbol in every occurrence of a trademarked name, we state that we are using the names only in an editorial fashion with no intention of infringement of the trademark.

For more information about this product or others available from NGDC, please contact us at:

NOAA/National Geophysical Data Center
325 Broadway
Boulder, Colorado 80303, U.S.A.

Telephone: (303) 497-6277
Fax: (303) 497-6513
Email: info@ngdc.noaa.gov
Web: http://www.ngdc.noaa.gov

Contents

Preface

Photographs of geologic hazards represent a unique form of data that capture the transience of Earth's periodic upheavals. The images taken of damage caused by these events are a permanent record that would otherwise have been erased forever by cleanup and reconstruction projects. Photographs serve as a reminder that such events can—and probably will—recur, and that we should be prepared to handle their consequences.

Photo images from the National Geophysical Data Center (NGDC), originally distributed as sets of twenty 35-mm slides, have been popular since they were introduced in 1982. The images have been used in analyses of geologic hazards, educational programs, and illustrations for publications. In 1993, we published our first photo CD compilation, which included all our slide sets up to that date. The 1997 release is a continuation of this program.

We view this as an evolving product. Your suggestions for future improvements are welcomed.

Susan J. McLean
Patricia Lockridge
Stewart Racey

National Geophysical Data Center
September 1997

Acknowledgments

Many individuals from the public and private sector have donated images to the NGDC photo archives. It is impossible to cite all contributors; often those who provide data to us have many sources included within their individual collections. Each contributor has played an important role in the study of hazards and their mitigation.

We are particularly grateful to the **U.S. Geological Survey**, whose scientists have provided many of the photographic images and descriptions on these CDs. Other contributing institutions include:

Government Contributors (U.S.):

State of California, Bay Area Earthquake Project
State of California, Division of Mines and Geology
State of Washington, Department of Natural Resources
U.S. Department of Commerce
U.S. Department of Defense
U.S. Department of Interior

Academia (U.S.):

California State University
Stanford University
State University of New York
University of California
University of Colorado
University of Hawaii
University of Washington

Organizations (U.S.):

AMOCO
CD-ROM, Inc., Golden, Colorado
Building Systems Development, Inc.
Dames and Moore, Inc.
Earthquake Engineering Research Institute

Non-U.S. Contributors:

Academy of Sciences, Russia
Bureau of Mineral Resources, Geology and Geophysics,

Australia
National Academy Press, Italy
Public Works Research Institute, Japan
Reinsurance Company of Munich, Germany
Romanian Academy, Romania

If you use these data for published research, it is appropriate to cite this compilation. We request that you also cite the contributing individual or organization. Photograph credits for each image are provided in the captions.

About the Compact Discs

Overview

The 1997 **Geologic Hazards Photos** compact disc set is an update to the 1993 release, which included 22 sets of thematic images in digital form. The current release contains all of the images from the 1993 edition, plus an additional 16 new sets and completely revised software.

The CDs are presented in three volumes. Volume 1 presents general earthquake topics and Volume 2 contains images from earthquake events. Volume 3 contains images of landslides, tsunami damage, and volcanic events and features.

The three volumes contain about 1,141 megabytes of data and information compiled from many different sources. The images are stored on the CDs in the International Organization for Standardization (ISO) 9660 format.

Data Preparation

The original data for this project were contributed as 35-mm slides or Kodak Photo CD format. All slides were converted to Kodak Photo CD format and then recorded as:

- Tagged Image Format (.TIF)
- Joint Photographic Experts Group Format (.JPG)
- Graphics Interchange Format (.GIF)

Each image format has advantages and disadvantages. Choices were based on desired usage of the images. TIF and JPG files are 24-bit RGB (red, green, blue) True Color. TIF files are easily imported into many graphics and desktop publishing applications, and provide the best detail of the three formats. The JPG format allows considerable compression of images without noticeable loss of detail to the human eye. JPG files are often used in Web page construction and are viewable with most Web browsers. GIF files are 8-bit 256 Color. GIF is also a popular Web

standard, although the image has less detail.

General Notes

If you previously had the 1993 release, you may wish to upgrade your images and software with the current release. All slide sets from the 1993 edition have been re-scanned for consistency. In many cases, this has resulted in improved color and image density. In addition, the GeoVu access and display software has newly added features.

Please note that the quality of the image displays are strongly dependent on your computer system. And, although GeoVu accesses GIF images for its on-screen display, the TIF images have the highest resolution. TIF images are recommended for any publication purposes.

Handle the CDs carefully to avoid damage. Dust, scratches, ink, paint, and fingerprints may obscure some of the data. Given careful handling, one can expect at least a 10-year lifetime for a data disc.

Getting Started

GeoVu software is provided on each CD for access and display of the image files and their captions. GeoVu will operate on PCs running Microsoft Windows 3.x or Windows 95, and on Macintosh, UNIX Sun, and UNIX Silicon Graphics computers.

The GeoVu installation files for these platforms are provided on the disc in subdirectories within SOFTWARE\GEOVU. Instructions for installing and running GeoVu on the different platforms are found in platform-specific README files in SOFTWARE\GEOVU\DOCUMNT.

Directory Structure

The three CDs contain similar directory structures. There are three main directories: DOCUMENT, SOFTWARE, and IMAGES.

Document Directory

The DOCUMENT directory contains this document in several different digital formats. It also contains HTML access files.

Software Directory

The SOFTWARE directory contains the GeoVu and FreeForm software. Each of the platform subdirectories contains software and installation instructions specific for that platform.

Additional documentation for GeoVu can also be found in the SOFTWARE\GEOVU\DOCUMNT directory. Brief instructions for downloading future upgrades of GeoVu from NGDC's File Transfer Protocol (FTP) site and installing the software are in GVQUICK. The GeoVu User's Manual is in GVHELP. Several versions of each file are available—Microsoft Word (files with .DOC extensions) for PCs, Adobe Portable Document Files (.PDF), Postscript files (.PS), and text files (.TXT).

FreeForm utilities for converting data to different formats are also included on the CDs. Please see the appropriate platform README file in the SOFTWARE\FREEFORM directory.

Images Directory

Photos are contained in the IMAGES directory. Each thematic image set is represented by a 6-digit number containing a TIF, JPG, and GIF version of the images. TIF and JPG images are 24-bit, and GIF images are 8-bit. The 6-digit representations are defined as follows:

Volume 1: Earthquakes—General Topics

647001 Earthquake Damage–General
647004 Earthquake Damage to Transportation Systems
647005 Earthquake Damage to Schools
647010 Faults
647022 The Behavior of Columns During Earthquakes
647023 Seismic Creep

Volume 2: Earthquake Events

647002 San Francisco, California, April 18, 1906
647003 Mexico City, Mexico, September 1985
647007 Great Alaska (Prince William Sound) Earthquake, March 28, 1964
647008 Southern California, 1979–1989
647009 Central California, 1980–1984
647011 The Armenian SSR, December 1988
647012 Loma Prieta, California, October 1989, Set 1—Loma Prieta Vicinity
647013 Loma Prieta, California, October 1989, Set 2—San Francisco/Oakland
647014 Northern Iran, Engineering Aspects, June 21, 1990
647016 The Cape Mendocino (California) Earthquakes, April 25 and 26, 1992
647017 The Landers and Big Bear (California) Earthquakes, June 28, 1992
647018 Northridge, California, January 17, 1994. Set 1—Community of Northridge
647019 Northridge, California, January 17, 1994. Set 2—Other Communities
647020 The San Fernando Valley (California) Earthquakes: February 9, 1971 and January 17, 1994
647021 The Great Hanshin-Awaji (Kobe) Earthquake, January 17, 1995
647025 The Shikotan, Kuril Islands, Earthquake, October 4, 1994

Volume 3: Landslides, Tsunamis, and Volcanoes

647006 Landslides
647015 Environmental Hazards and Mud Volcanoes in Romania

647024 Erosional Landforms
648001 Tsunamis–General
648002 The Major Tsunamis of 1992—Nicaragua and Indonesia
648003 The Hokkaido Nansei-Oki Tsunami, July 12, 1993
739001 Volcanoes in Eruption, Set 1
739002 Volcanic Rocks and Features
739003 Volcanoes in Eruption, Set 2
739004 The Eruption of Mount Saint Helens, May 1980
739005 Hawaii Volcanism: Impact on the Environment
739006 Hawaii Volcanism: Lava Forms
739007 Mount Pinatubo, Philippines: June 1991 Eruptions
739008 The Crater Peak (Mount Spurr), Alaska: Eruptions of 1992
739009 Mount Pinatubo Revisited; A Study of Lahar Erosion
SLIDE01 Global Relief Slide Sets

Individual photos are sequentially numbered from 01-20; a list of titles begins on page 11. The captions are automatically accessed when using GeoVu, or they may be read separately, with your own software. Complete captions for each of the images can be found in the individual menu (.MEN) files.

Image Titles

Photos are located in the IMAGES directory of each CD-ROM. Each set of images (represented by 6-digit numbers) contains GIF, TIF, and JPG subdirectories. The images are sequentially numbered from 01 through 20, with the appropriate file extension.

The following list contains a one-line descriptor of every image. Complete captions may be accessed through the use of GeoVu (which will display the image and caption together). Or, captions may be accessed individually by viewing the on-line menu files through a network browser such as Netscape or Microsoft Internet Explorer.

Volume 1: Earthquakes—General Topics

647001. Earthquake Damage-General

01. Compression of fence, Hebgen Lake, Montana (1959)
02. Slumping of highway into Hebgen Lake, Montana (1959)
03. Government Hill School (1964)
04. Slumping of Turnagain Heights subdivision, Anchorage, Alaska (1964)
05. Leaning apartment houses in Niigata, Japan (1964)
06. Union Pacific Railway damage from ground deformation, Seattle, Washington (1965)
07. Tipped residence due to differential settling, Caracas, Venezuela (1967)
08. Surface rupture, Meckering, Australia (1968)
09. City street, Huaraz, Peru, before 1970 earthquake
10. City street, Huaraz, Peru, after 1970 earthquake
11. Compression of freeway, San Fernando, California (1971)
12. Offset of trees along fault, Motagua, Guatemala (1976)
13. Twisted railroad tracks across fault, Guatemala (1976)
14. Landslide near Guatemala City, Guatemala (1976)
15. Liquefaction, Motagua Valley, Guatemala (1976)
16. Support pillar failure, Imperial County Services Building, El Centro, California (1979)
17. Offset of lettuce rows across fault, El Centro, California (1979)
18. Slumping near El Centro, California (1979)
19. Sand boil produced by liquefaction, El Centro, California (1979)

20. Collapsed unit of Pallante Factory, Campania, Italy (1980)

647004. Earthquake Damage to Transportation Systems

01. Tsunami bore destroys bridge on Wailuku River, Hawaii (1946)
02. Highway slumped into lake after earthquake shaking, Hebgen Lake, Montana (1959)
03. Car straddles crack in road after Alaska earthquake (1964)
04. Damage to Fourth Ave., Anchorage, Alaska earthquake (1964)
05. Compression of railroad track, Alaska earthquake (1964)
06. Damage to railroad bridge, Alaska earthquake (1964)
07. Tsunami damage to railroad facilities, Alaska earthquake (1964)
08. Boat beached by tsunami, Alaska earthquake (1964)
09. Collapsed bridge after earthquake in Japan (1964)
10. Damage to railway, Seattle, Washington, earthquake (1965)
11. Freeway compression caused by San Fernando, California, earthquake (1971)
12. Collapsed overpass caused by San Fernando, California, earthquake (1971)
13. Railroad tracks twisted by fault trace, Guatemala earthquake (1976)
14. Collapse of spans on bridge, Guatemala earthquake (1976)
15. Landslide blocks highway after Morgan Hill, California, earthquake (1984)
16. Rockfall blocks highway after Palm Springs, California, earthquake (1986)
17. Collapse of streets caused by subsidence from Mexico City earthquake (1985)
18. Blocking of roadways caused by building collapse in the Armenia earthquake (1988)
19. Collapse of freeway, Loma Prieta, California, earthquake (1989)
20. Damage to San Francisco-Oakland Bay Bridge, Loma Prieta earthquake (1989)

647005. Earthquake Damage to Schools

01. Damage at Charleston College, South Carolina (1886)
02. Damage to library at Stanford University, Palo Alto, California (1906)
03. Damage to chapel at Stanford University (1906)
04. Damage to high school at Three Forks, Montana (1925)
05. Damage to school at Manhattan, Montana (1925)

06. Collapse of school, Long Beach, California, earthquake (1933)
07. Crumbled walls of high school in Long Beach, California (1933)
08. Damage to Helena, Montana, high school (1935)
09. Collapsed school in Kern County, California (1952)
10. Collapse of stone entry at elementary school, Hebgen Lake, Montana (1959)
11. School split by slumping ground, Alaska earthquake (1964)
12. Damage to school, Veracruz, Mexico, earthquake (1973)
13. Damage to school, Lima, Peru, earthquake (1974)
14. Damage to school, Lice, Turkey, earthquake (1975)
15. Damage to school, Esmeraldas, Ecuador, earthquake (1976)
16. Collapse of school, Tangshan, China, earthquake (1976)
17. Damage to school, Cadoux, Australia, earthquake (1979)
18. Collapsed school, El Asnam, Algeria, earthquake (1980)
19. Interior damage to school, Coalinga, California, earthquake (1983)
20. Interior collapse at school, Spitak, Armenia, earthquake (1988)

647010. Faults

01. Fault block diagram
02. Aerial view of San Andreas Fault
03. View of cross section of San Andreas Fault
04. Second view of cross section of San Andreas Fault
05. Drain offset caused by seismic creep
06. Fence offset produced by San Francisco earthquake (1906)
07. En echelon fractures along Imperial Fault
08. Offset of woodpile along Imperial Fault
09. Offset of rows in plowed field
10. Offset of cement-lined ditch in Guatemala
11. Deformation of rows by Guatemala earthquake (1976)
12. Tree bisected by fault in Guatemala
13. Fault scarp near Hebgen Lake, Montana
14. Fault scarp caused by Borah Peak, Idaho
15. Fault scarp and horizontal offset near Dickey, Idaho
16. Oblique-slip fault scarp near Pleasant Valley, Nevada
17. Oblique-slip fault scarp at Flamingo Heights, California
18. Reverse fault near Clark County, Montana
19. Blind thrust fault scarp at El Asnam, Algeria
20. Under-thrust fault from nuclear test

647022. The Behavior of Columns During Earthquakes

01. First-story column failure, San Fernando, California (1971)
02. Spirally-wrapped column failure at Interstate 5/210 interchange, San Fernando, California (1971)
03. Collapsed column, Interstate 5/210 interchange, San Fernando, California (1971)
04. Column failure, Holy Cross Hospital, San Fernando, California (1971)
05. Failure of several columns, Foothills Freeway Overpass, San Fernando, California (1971)
06. Spirally-wrapped column failure, Esmeraldas, Ecuador (1976)
07. Imperial County Services Building, El Centro, California (1979)
08. Damaged columns, Imperial Count Services Building, El Centro, California (1979)
09. Buckled box column, Mexico City (1985)
10. Close-up of colum failure at Juarez Hospital, Mexico City (1985)
11. Failed first-story column, Mexico City (1985)
12. Shattered columns under Economics Building, San Salvador, El Salvador (1986)
13. Porch column tipped when house shifted on foundation, Whittier, California (1987)
14. Collapsed Cypress section of Interstate 880, Loma Prieta, California (1989)
15. Bases chipped when columns tipped during Loma Prieta, California, earthquake (1989)
16. Overpass columns damaged in Northridge, California, earthquake (1994)
17. Parking garage columns damaged in Northridge, California, earthquake (1994)
18. Splayed column bases, Northridge, California (1994)
19. Failed bridge support, Northridge, California (1994)
20. “Short column” effect, Northridge, California (1994)

647023. Seismic Creep

01. Calaveras fault crosses street in Hollister, California
02. Creep on Locust Street as it looked in 1966 and 1992
03. Tipped house foundation along fault
04. Fault trace crosses intersection
05. Effect of 16 years of creep on curb
06. Walkway as it appeared in 1985 and in 1991
07. Two views of a slightly-bent curb
08. “Wavy” curb produced by seismic creep

09. Curb on opposite side of street
10. Bend in curb caused by seismic creep
11. Bend in sidewalk, Hollister
12. Broken curb, Hollister
13. Offset of street's center line at fault trace
14. Offset of culvert near Almaden Cienega Winery
15. Building damage caused by creep in Hayward, California
16. En echelon shears crossing street, Hayward
17. Curb offset in 1974 and 1993
18. Offset of fence in Hayward
19. Effect of creep on stadium, Berkeley, California
20. Distorted fence, Melendy Ranch, California

Volume 2: Earthquake Events

647002. San Francisco, California, April 18, 1906

01. Fault trace breaks fence northwest of Woodville
02. Skinner's barn offset by fault trace
03. Fault severs house, Santa Cruz County
04. Road cracks caused by earthquake
05. Buckling of Union Street
06. Compression of street car rails
07. Tipped house on Howard Street
08. Compression of paving in Mission District
09. Tilted buildings caused by ground failures
10. Horses killed by falling bricks
11. Severely damaged San Francisco City Hall
12. Damage to library at Stanford University
13. Damage to Memorial Church, Stanford University
14. Damage to store in Palo Alto
15. Damage to First Baptist Church in Oakland
16. Collapse of City Hall at Santa Rosa
17. Panoramic view of San Francisco in flames
18. Tent camp for earthquake victims
19. View of devastation looking toward Market Street
20. Panoramic view of nearly total devastation of San Francisco

647003. Mexico City, Mexico, September, 1985

01. Graphic showing types of buildings damaged
02. Diagram of four common patterns of building failure

03. Failure of top floors, Hotel Continental, Mexico City
04. Aerial view of top failure, Central Communications Center
05. Top failure of flexible building between two rigid buildings
06. Top-floor collapse office building, Mexico City
07. Top failure of reinforced concrete building, Mexico City
08. Top failure of reinforced concrete building, Mexico City
09. Close-up of damage to Hotel de Carlo
10. High-rise building twisted in earthquake
11. Earthquake oscillations cause collapse of vertical supports
12. Parking garage collapse
13. Bottom-level failure due to weak first floor
14. Building sunk into liquefied soil
15. Collapsed school building
16. Collapsed floors punctured by load-bearing column
17. Total collapse of Juarez Hospital
18. Totally collapsed 21-story steel frame office building
19. Car demolished by debris
20. Totally collapsed and undamaged office buildings

647007. Great Alaska (Prince William Sound) Earthquake, March 28, 1964

01. Uplifted dock, Prince William Sound
02. Subsidence at Portage
03. Hanning Bay fault scarp
04. Underwater landslides at Seward
05. Government Hill landslide, Anchorage
06. “L” Street landslide, Anchorage
07. Damaged Four Seasons Apartments, Anchorage
08. Scarp in “L” Street slide, Anchorage
09. Damage to Fourth Avenue, Anchorage
10. Fourth Avenue landslide scarp, Anchorage
11. Turnagain Heights landslide, Anchorage
12. Damage to J.C. Penny Building, Anchorage
13. Fissured highway embankment
14. Bridge damage, Twentymile River
15. Bridge damage on the Cooper River
16. Damage to rails at Seward Port
17. Tank farm fire, Valdez
18. Tsunami damage to spruce trees, Port Valdez
19. Tsunami damage near Seward
20. Tsunami damage near Resurrection Bay

647008. Southern California, 1979–1989

01. Imperial County Services building, El Centro, California, before and after 1979 earthquake
02. Earth cracks near El Centro (1979)
03. Sand boil near El Centro (1979)
04. Merchandise on floor after Imperial Valley earthquake (1979)
05. Fallen porch, Imperial Valley earthquake (1979)
06. Fault trace across lettuce field, Imperial Valley earthquake (1979)
07. Damage to theater at Brawley, California, Imperial Valley earthquake (1979)
08. Damage to adobe building, Westmorland, California, earthquake (1981)
09. Collapsed building, Westmorland earthquake (1981)
10. Porch damage, Palm Springs, California, earthquake (1986)
11. Rockfall on highway after Palm Springs earthquake (1986)
12. Damage to display window, Palm Springs earthquake (1986)
13. Collapsed concrete block fence, Palm Springs earthquake (1986)
14. Two views of auditorium showing damage from Whittier, California, earthquake (1987)
15. Partial collapse of store, Whittier earthquake (1987)
16. Shift of apartment building, Whittier earthquake (1987)
17. Partial collapse of parking garage, Whittier earthquake (1987)
18. Exterior view of damaged residence, Whittier earthquake (1987)
19. Interior view of damaged residence, Whittier earthquake (1987)
20. Collapse of wall of store, Whittier earthquake (1987)

647009. Central California, 1980–1984

01. Fallen bookcases at the Lawrence Livermore Laboratory (1980)
02. Tilted bookcases at the Lawrence Livermore Laboratory (1980)
03. Tipped filing cabinets at the Lawrence Livermore Laboratory (1980)
04. Aerial view of 5th Street and Elm Avenue, Coalinga, California (1983)
05. Street level view of damaged building at 5th Street and Elm Avenue, Coalinga (1983)
06. Close-up view of building at corner of 5th Street and Elm Avenue, Coalinga (1983)
07. Roof collapse in central business district, Coalinga (1983)
08. Damage to State Theater building, Coalinga (1983)

09. Wall damage to building in downtown Coalinga (1983)
10. Second floor wall failure on Coalinga house (1983)
11. Porch columns damage, residence in Coalinga (1983)
12. Total collapse of front of residence, Coalinga (1983)
13. Interior damage, Coalinga Junior High School (1983)
14. Interior damage, Coalinga Junior High School (1983)
15. Landslide near Morgan Hill, California (1984)
16. Residence damage, Morgan Hill (1984)
17. Cracks in roadway, Morgan Hill (1984)
18. Roadway and garage damage, Jackson Oaks (Morgan Hill, 1984)
19. Residence moved off foundation, Jackson Oaks (Morgan Hill. 1984)
20. Liquefaction damage to earthen dam, Morgan Hill (1984)

647011. The Armenian SSR, December, 1988

01. Collapse of stone masonry bearing-wall, Alivar, Armenia
02. Collapsed structures, Alivar
03. Collapsed stone masonry building, Alivar
04. Collapsed masonry building, Arevashok
05. Collapse of composite structure, Spitak
06. Damage to sugar beet refinery, Spitak
07. Damage to flour mill complex, Spitak
08. Damage to granary, Spitak
09. Damage to communications building, Spitak
10. Partial collapse of masonry building, Spitak
11. Partial destruction of masonry building, Spitak
12. Collapse of stone masonry building, Spitak
13. Damage to central Spitak
14. Damage to concrete-frame building, Leninakan
15. Collapse of floors, Leninakan
16. Collapse of masonry church, Leninakan
17. Earthquake-induced landslide, Alivar
18. Iceberg produced by broken pipe near Spitak
19. Thrust fault, Armenia
20. Right-lateral strike slip fault near Spitak

6470012. Loma Prieta, California, October 1989, Set 1—Loma Prieta Vicinity

01. Collapsed home, Boulder Creek, California
02. Damage to home in Boulder Creek

03. Landslide, Scott's Valley
04. House damage, Santa Cruz Mountains
05. Major damage to 90-year-old home, Los Gatos
06. Damage to parapet and arch, bike shop, Los Gatos
07. Damage to parapet, Downtown Liquors, San Jose
08. Damage to masonry building, San Jose
09. Facade cracking, San Jose
10. Fissures, Santa Cruz Mountains
11. Fissure on San Andreas Summit Road, Santa Cruz
12. Damage to Church, Santa Cruz Mountains
13. Porch damage, wood frame house, Santa Cruz Mountains
14. Tree snapped off by the earthquake, Santa Cruz Mountains
15. Damage to Pacific Garden Mall, Santa Cruz
16. Close-up view of damage to Pacific Garden Mall, Santa Cruz
17. Damage to shops in Aptos
18. Parapet damage, Beach Street, Watsonville
19. Parapet damage, Main and Second Street, Watsonville
20. Structure, shifted on foundation, Watsonville

647013. Loma Prieta, California, October 1989, Set 2—San Francisco and Oakland

01. Collapsed 4th-story wall, San Francisco, California
02. Damaged cars in which 5 people were killed, San Francisco
03. Cracks in building, Marina District, San Francisco
04. House shifted on foundation, Marina District, San Francisco
05. Collapsed building, San Francisco
06. Demolition of collapsed building, San Francisco
07. View of damage along Jefferson Street, San Francisco
08. Shored building in the Marina District, San Francisco
09. Detail of shoring to garage, Marina District, San Francisco
10. Collapsed building in the Marina District, San Francisco
11. Collapsed building, Marina District, second view
12. Rubble left after fire in Marina District
13. Demolished cars and rubble, Marina District
14. Sidewalk damage produced by liquefaction, Marina District, San Francisco
15. Evidence of liquefaction in the Marina District, San Francisco
16. Damage to top floor of Clay Building, Oakland, California
17. Aerial view of collapsed Interstate 880, Oakland, California
18. Side view of the collapsed section of Interstate 880, Oakland, California

19. View of damage to San Francisco–Oakland Bay Bridge
20. Damage to truss support bearing shoe, San Francisco–Oakland Bay Bridge

647014. Northern Iran, Engineering Aspects, June 21, 1990

01. Building damaged by ground failure, Iran
02. Differential settlement, liquefaction, Iran
03. Destruction of unreinforced masonry buildings, Iran
04. Collapse of unreinforced masonry buildings, Iran
05. Roof collapse, Iran
06. Parapet and roof collapse, Iran
07. X-cracking in shear walls, Iran
08. Structural damage to walls, Iran
09. Damage to unreinforced masonry infill walls, Iran
10. Damage to building with reinforced infill walls, Iran
11. Damage due to inadequate cross-bracing, Iran
12. Tilt of 8-story steel structure, Iran
13. Damage to building with rod bracing, Iran
14. Concrete frame construction, Iran
15. Collapse of mid-rise concrete building, Iran
16. Total failure of mid-rise concrete building, Iran
17. Damage to elevated concrete water tank, Iran
18. Collapse of concrete water tank, Iran
19. Pier displacement of concrete bridge, Iran
20. Sefidrud Dam, Iran

647016. The Cape Mendocino (California) Earthquakes, April 25 and 26, 1992

01. Garage slid down hill due to earth shaking
02. View of mall at Scotia that was destroyed by fire
03. Second view of Scotia mall
04. Support pillar on Scotia's Lumber Museum
05. Damage to 70-year old house and chimney in Honeydew
06. Remains of Petrolia's business district after earthquake and fire
07. Chimney damage in Petrolia
08. Earthquake bounced this front-end loader one foot into the air
09. Petrolia residence shifted on foundation
10. Residence south of Petrolia that shifted off foundation
11. Second view of damage to residence south of Petrolia
12. Third view of damage to residence south of Petrolia

13. Removal of landslide on Mattole Road
14. Landslide on Mattole Road
15. Cracks on Mattole Road
16. Ferndale's Valley Grocery lost brick facade smashing two cars
17. Victorian wood-frame home slide on foundation in Ferndale
18. Chimney damage to Victorian home in Ferndale
19. Sandblow in Mattole showing liquefaction
20. Uplift of coastline near Mussel Rocks caused death of organisms

647017. The Landers and Big Bear (California) Earthquakes, June 28, 1992

01. Four to six foot fault scarp, Landers earthquake
02. Liquefaction adjacent to Santa Ana River near Big Bear epicenter
03. Ground cracking near Aberdeen
04. Buckled water tank lifted off base by Landers earthquake
05. Exterior of house 20 yards from fault scarp
06. View of same house (# 05) showing movement on foundation
07. Details of collapse of house (# 05)
08. Close-up of damaged house (# 05)
09. Large crack in cement floor (same house as in #05)
10. Damage to bowling alley near Landers epicenter
11. Detail of damage to bowling alley
12. Damage to Monument Market near Landers epicenter
13. Detail of damage to Monument Market
14. Landslides along Highway 18 in the San Bernardino Mountains
15. Repair of earthquake-damaged road
16. Path of huge boulder dislodged by Big Bear earthquake
17. Dislodged boulder destroyed forest in its path
18. One of the large dislodged boulders rests against a tree
19. Collapse of a chimney on home at Big Bear City
20. Roof damage to restaurant in Big Bear City

647018. Northridge, California, January 17, 1994, Set 1—Community of Northridge

01. Partial collapse of Bullocks Department Store
02. Second view of Bullocks Department Store
03. Back side of Bullocks Department Store
04. Cracking in store at Northridge Mall
05. Damage to parking structure at Northridge Mall
06. Second view of damage to parking structure

07. Garage that incurred little damage at Northridge Mall
08. Collapsed roof near Northridge Mall
09. Collapse of first floor at Northridge Meadows Apartments
10. Second view of damage at Northridge Meadows Apartments
11. Partially collapsed apartment building
12. Collapsed apartment building in Northridge
13. Collapse of building onto carport
14. Second view of collapsed apartment building
15. Relatively undamaged apartment building
16. Interior of damaged apartment building
17. Second view interior of damaged apartment building
18. Partially collapsed parking structure, California State University
19. Second view of collapsed parking structure
20. Undamaged Great Western Bank Building

647019. Northridge, California, January 17, 1994, Set 2—Other Communities

01. I-5 and SR14 Freeway collapse
02. Damage in Sylmar Mobile Home Park
03. Damage in historical area of Fillmore
04. Damage to unreinforced masonry building in Fillmore
05. Damage to Kaiser Clinic in Granada Hills
06. Second view of damage to Kaiser Clinic
07. Total collapse of end wall in Reseda
08. Collapse of apartment building over garage in Reseda
09. Second view of same building
10. Damage to cast-in-place garage in Van Nuys
11. Damaged apartment in Sherman Oaks
12. Damage to tilt-up building in Chatsworth
13. Chimney damage in Santa Monica
14. Damage to car dealership in Santa Monica
15. Wall failure in retrofitted masonry building
16. Near-collapse of second floor, hospital in Santa Monica
17. Upper floor damage, unreinforced masonry, Santa Monica
18. Unreinforced masonry apartment, Santa Monica
19. Failure of I-10 in Culver City
20. Damage to historic Los Angeles Memorial Coliseum

647020. San Fernando Valley (California) Earthquakes, February 9, 1971 and January 17, 1994

01. Damage at I-5 and I-210 Freeway Interchange (1971)
02. Damage at I-5 and C-14 Freeway Interchange (1971)
03. Damage at I-5 and C-14 Interchange (1994)
04. Van Norman Dam partial collapse (1971)
05. Collapsed condenser banks, Sylmar Converter Station (1971)
06. Buckled sidewalks in front of Juvenile Hall (1971)
07. Buckled sidewalks in northern Granada Hills (1994)
08. Damaged home in Crestview Park (1971)
09. Damaged home north of San Fernando Valley (1994)
10. Location of fatalities, Northridge Meadows Apartments (1994)
11. Aerial view of damage to San Fernando Veterans Administration Hospital (1971)
12. Damage to building at Veterans Administration Hospital complex (1994)
13. Damaged Kaiser Permanente Medical Building (1994)
14. Aerial view of damaged Olive View Hospital (1971)
15. Olive View Hospital replacement fares well in 1994 quake
16. Damaged Juvenile Hall facilities (1971)
17. Interior damage in San Fernando Mall (1971)
18. Damage at Bullocks in Northridge Fashion Center (1994)
19. Damage to parking structure at Northridge Fashion Center (1994)
20. Collapsed parking structure, California State University (1994)

647021. The Great Hanshin-Awaji (Kobe) Earthquake, January 17, 1995

01. Badly damaged communication building
02. Totally collapsed Buddhist temple
03. Lobby of Oriental Hotel
04. Damaged Kobe waterfront
05. Cars and buildings have slipped into the bay
06. Collapsed fifth floor of high rise
07. Collapsed walkway between two buildings
08. Collapsed first floor of retail store
09. Leaning office building
10. Office building with partially destroyed first floor
11. Completely destroyed concrete frame building
12. Collapsed fifth floor in central business district
13. Truck crushed beneath fallen debris
14. Completely destroyed apartment complex
15. Collapsed first and second stories
16. Major split in foundation

17. Smoke from Kobe fires
18. Damaged support for Kobe expressway
19. Collapsed residential building
20. Collapsed residential garage

647025. The Shikotan, Kuril Islands, Earthquake, October 4, 1994

01. Major landslide formation near Malokurilskoe
02. Landslide formation, view to the north
03. Landslide formation, view to the east
04. Landslide formation, another view
05. Landslide formation, view to the south
06. Ground crack near Krabosavodskoe
07. Ground crack from another view
08. Secondary crack
09. Ground cracks near an apartment building, Malokurilskoe
10. Damage to cinema building in Malokurilskoe
11. Damage to the elementary school in Krabosavodskoe
12. Another view of the school
13. Damage to a cemetery, east coast of Shikotan Island
14. Gorobets Bay after the tsunami
15. Valley of a small stream near Dimitrova Bay, showing tsunami run-up height
16. Tsunami run-up boundary at Dimitrova Bay
17. Soil erosion caused by tsunami, Dimitrova Bay
18. Another example of soil erosion caused by tsunami run-up
19. Large rock which fell into Krabovaya Bay during earthquake
20. View of subsidence along coastline

Volume 3: Landslides, Tsunamis, and Volcanoes

647006. Landslides

01. Talus cones, Glen Canyon
02. Rock slide, Frank, Alberta, Canada
03. Rock and snow avalanche, Mount Hauscaran, Peru
04. Rockfall avalanche, Mount Rainer, Washington
05. Slide and alluvial fan, Madison River, Montana
06. Talus cones in the Canadian Rockies
07. Mudflow, Climax, Colorado
08. Mudflow scar, Rocky Mountain National Park, Colorado

09. Slumgullian mudflow, Lake City, Colorado
10. Mudflow, Death Valley, California
11. Earthflow, southern Australia
12. Earthflow, Mission Pass, California
13. Slump, Pacific Palisades, Southern California
14. Earthflow, Chalet Du Fer, Leysin, Switzerland
15. Head of slump, Black Hills, North Dakota
16. Subsidence, San Joaquin Valley, California
17. Sinking, coal mine collapse, Lafayette, Colorado
18. Rock Glaciers, Mount Sopris, Colorado
19. Solifluction flows, Alaska
20. Creep, Marathon, Texas

647015. Environmental Hazards and Mud Volcanoes in Romania

01. Slopes affected by reactivation of landslides in eastern Carpathians
02. Rockfall area on steep slopes in eastern Carparthians
03. Rockfalls in the Buzau Mountains caused by March 1977 earthquakes
04. Second view of rockfalls in Buzau Mountains
05. Rock block slide along planar surface in eastern Carpathians
06. Second view of block slide in eastern Carpathians
07. Scarp of slump in Getic Subcarpathians
08. Large landslide that destroyed 30 houses in Subcarpathians
09. Second view of landslide that destroyed 30 houses
10. Translation landslide that blocked valley in Subcarpathians
11. Shallow slide topography in the Subcarpathians
12. Large complex landslide in Subcarpathians
13. Landslide study area near Patarlagele Research Station
14. Mudflow near Panatau village in Subcarrpathians
15. Sheet erosion, gullies, and landslides
16. Heavily eroded slope in Moldavian Plateau
17. Head of gully in Moldavian Plateau
18. Mud volcano cones in Berca Anticline
19. Second view of mud volcano cones in Berca Anticline
20. Oil rich mudflow in Berca Anticline

647024. Erosional Landforms

01. Headlands and arches, Oregon coast
02. Headlands and sea stacks, Oregon coast
03. Alcove in canyon wall, Lake Powell, Arizona

04. Delicate Arch, Moab, Utah
05. Balancing Rock, Moab, Utah
06. Rainbow Bridge, Arizona
07. Pothole, Paige, Arizona
08. Cross-bedding, Zion National Park, Utah
09. Cliff erosion, Bryce Canyon, Utah
10. Canyonlands, Moab, Utah
11. Whittier Trail, Canyonlands, Utah
12. San Andreas Fault, California
13. Devils Tower, Wyoming
14. V-shaped valley, Zion National Park, Utah
15. Mature Grand Valley, Colorado
16. U-shaped valley, Alberta, Canada
17. U-shaped valley, Rocky Mountain National Park, Colorado
18. Glacial erosion, Grand Tetons, Wyoming
19. Hanging Valley, Yosemite National Park, California
20. Glacier in Ice Fields Parkway, Canada

648001. Tsunamis-General

01. Scotch Cap Lighthouse before tsunami (1946)
02. Scotch Cap Lighthouse after tsunami (1946)
03. (1) Tsunami wave generated in Alaska runs up Hawaii beach (1946)
04. (2) Another view of #03 (1946)
05. Clubhouse in Hilo, Hawaii, wrecked by tsunami (1946)
06. Tsunami generated in Alaska breaks pier in Hilo, Hawaii (1946)
07. Midway Island flooded by Kamchatka tsunami (1952)
08. Aerial view of Kamchatka tsunami striking Hawaii Beach (1952)
09. (1) Hawaii beach before arrival of Aleutian Islands tsunami (1957)
10. (2) Tsunami strikes Hawaii beach (1957)
11. (3) Tsunami engulfs Hawaii beach (1957)
12. Aerial view of Chilean Coast after tsunami (1960)
13. Aftermath of Chilean tsunami in Hilo, Hawaii (1960)
14. Surge wave produced by Alaska earthquake (1964)
15. Aerial view of Valdez, Alaska, after tsunami (1964)
16. Resurrection Bay, Seward, Alaska, after tsunami (1964)
17. Hawaii beach after tsunami (1975)
18. (1) Water begins to withdraw from Japan coastline as tsunami approaches (1983)
19. (2) Inundation at maximum level during Japan tsunami (1983)
20. (3) Area of inundation after withdrawal of the wave (1983)

648002. The Major Tsunamis of 1992—Nicaragua and Indonesia

01. Damage at El Tranisto, Nicaragua
02. Beach at El Popoyo, Nicaragua
03. Structures at El Popoyo, Nicaragua
04. Contrasting construction, El Popoyo, Nicaragua
05. Structural damage, El Popoyo, Nicaragua
06. Damaged structures, Marsella, Nicaragua
07. Destruction of Riangkroko, Indonesia
08. Aerial view of Riangkroko, Indonesia
09. Upper extent of inundation, Riangkroko, Indonesia
10. Tree remains after tsunami, Riangkroko, Indonesia
11. Remaining debris at Riangkroko, Indonesia
12. Upper extent of inundation, Riangkroko, Indonesia
13. Effects of tsunami, Leworahang, Indonesia
14. Effects of tsunami, Leworahang, Indonesia
15. Slump area, Leworahang, Indonesia
16. Slumps at Lewobele, Indonesia
17. Complete devastation at Pagaraman, Babi Island, Indonesia
18. Complete destruction at Kampungbaru, Babi Island, Indonesia
19. Debris dump Kampungbaru, Indonesia
20. Effects at Wuhring, Floress Island, Indonesia

648003. The Hokkaido Nansei-Oki Tsunami, July 12, 1993

01. Tsunami and fire damage, southeastern Okushiri Island
02. Tsunami damage at Aonae, Okushiri Island
03. Clock at Aonae showing arrival time of wave
04. Scattered debris at Aonae, Okushiri Island
05. Beached fishing boat at Aonae, Okushiri Island
06. Aonae, Okushiri Island, looking north; all that remains of a prosperous tourist area
07. Same location as #06, looking south
08. Debris scattered near harbor at Aonae, Okushiri Island
09. High water mark of five meters shown on side of damaged house
10. Small fishing boats deposited near harbor at Aonae
11. Clock half buried in sand shows travel time of twenty minutes
12. Large barge that was moved 75 m by waves
13. Fishing boat deposited on concrete shore protection barrier, Aonae
14. A small valley, western Okushiri Island

15. Damage at Monai, western Okushiri Island
16. Debris line at Monai, westerm Okushiri Island
17. Debris on highway overpass near Monai, Okushiri Island
18. Debris in overhead utility wires, western Okushiri Island
19. Vegetation stripped from hillside, western Okushiri Island
20. Waves overtopped roadway, western Okushiri Island

739001. Volcanoes in Eruption, Set 1

01. Barcena, Mexico (1952)
02. Cerro Negro, Nicaragua (1971)
03. Etna, Sicily (1979)
04. Irazu, Costa Rica (1964)
05. Izalco, El Salvador (1949)
06. Kilauea, Hawaii (1959)
07. Kilauea, Hawaii rift eruption (1983)
08. Krishima, Japan
09. Lamington, Papua New Guinea (1951)
10. La Soufriere, Guadeloupe (1976)
11. Las Pilas, Nicaragua (1952)
12. Lassen Peak, California (1915)
13. Masaya, Nicaragua (1951)
14. Mayon, Luzon, Philippines (1968)
15. Ngauruhoe, New Zealand (1974)
16. Pacaya, Guatemala (1976)
17. Paricutin, Mexico (1944)
18. Mount Saint Helens, Washington (1980)
19. Stromboli, Italy (1951)
20. Surtsey, Iceland (1963)

739002. Volcanic Rocks and Features

01. Pahoehoe lava, Hawaii
02. Aa lava, Hawaii
03. Volcanic glass, Hawaii
04. Lava tubes, Hawaii
05. Columnar jointing, Devil’s Postpile, California
06. Pasty lava extrusions, Mount Shasta, California
07. Pillow lava, near Oamaru, New Zealand
08. Welded tuff, Yellowstone, Wyoming
09. Diamond Head, Oahu, Hawaii
10. Volcanic bombs, Canary Islands
11. Bomb sag, Dotsero, Colorado

12. Spatter cone, Kilauea, Hawaii
13. Spatter cones, Craters of the Moon, Idaho
14. Eroded volcanic neck, near Brisbane, Australia
15. Devils Tower, Wyoming
16. Shiprock, New Mexico, an eroded volcanic neck
17. Great wall dike igneous intrusion, Colorado
18. Volcanic sills in Hofn, Iceland
19. Volcanic sill, near Edinburgh, Scotland
20. Laccolith (small magma chamber), Colorado

739003. Volcanoes in Eruption, Set 2

01. Augustine, Alaska (1986)
02. Cerro Negro, Nicaragua (1947)
03. Galunggung, Indonesia (1982)
04. Irazu, Costa Rica (1964)
05. Kilauea, Hawaii (1977)
06. Kilauea, Hawaii spatter cones (1983)
07. Krakatau, Indonesia (1883, drawing)
08. Mauna Loa, Hawaii
09. Mayon, Luzon, Philippines (1968)
10. Nevado del Ruiz, Colombia (1985)
11. Ngauruhoe, New Zealand (1968)
12. Paricutin, Mexico
13. Paricutin, Mexico night eruption (1943)
14. Mount Saint Helens, Washington (1983)
15. Santorini, Greece (1866, engraving)
16. Soufriere, Saint Vincent, West Indies (1979)
17. Surtsey, Iceland (1963)
18. Taal, Philippines (1965)
19. Veniaminof, Alaska (1984)
20. Volcan de Fuego, Guatemala (1974)

739004. The Eruption of Mount Saint Helens, Washington, May 1980

01. Mount Saint Helens, before volcanic activity began
02. Buried cascade ashes are witness to previous volcanic activity in the Cascades
03. First evidence of activity at Mount Saint Helens
04. Ash darkens slopes of Mount Saint Helens, as activity continues
05. Second crater forms at the summit of Mount Saint Helens
06. “Bulge” forms on N-NE flank of Mount Saint Helens

07. Steam eruption at Mount Saint Helens, prior to the May 18 eruption
08. The ash cloud formed by the May 18 eruption
09. Ash cloud from distance of three miles
10. Aerial view of Mount Saint Helens after major eruption of May 18
11. Mount Saint Helens, and devastation produced by May 18 eruption
12. Eruption cloud from Yakima, Washington
13. Ash fall at Sand Point, Idaho
14. Uprooted trees in blast-devastated area near Mount Saint Helens
15. Deforestation resulting from the May 18 blast at Mount Saint Helens
16. Mud flow on Toutle River
17. “Crater” formed from contact of hot volcanic debris with water
18. Spirit Lake after the May 18 eruption at Mount Saint Helens
19. Snow plow removes volcanic ash near Coeur D’Alene, Idaho
20. Lava dome, Mount Saint Helens, three years after the May 18 eruption

739005. Hawaii Volcanism: Impact on the Environment

01. Aerial view of lava flow in Royal Gardens
02. Lava crossing highway
03. House consumed in lava flow
04. Lava fountains along rift
05. Cars trapped in lava flow
06. Attempts to block lava flow
07. Lava flow consumes Wahaula Vistor Center
08. Lava flow traverses highway
09. Earthquake crack severs road
10. Attempts to divert flow
11. Lava flow burns power line pole
12. Cinders strip leaves from papaya trees
13. Lava flow consumes vegetation
14. Lava tree molds
15. Vegetation begins to grow on cold flow
16. Lava flow builds a coastal bench
17. Marine life killed by hot flows entering sea
18. Lava flow extends coastline
19. Geothermal power in Hawaii
20. Observation of spectacular lava fountain

739006. Hawaii Volcanism: Lava Forms

01. Fountain, Pu'u O'o vent
02. Mauna Ulu lava fountain
03. Kilauea Iki fountain
04. Spatter at vent, Mauna Loa
05. Dome fountains, Mauna Ulu
06. Drainback, Mauna Ulu
07. Lava lake, Kilauea Summit
08. Surface pattern, Lava Lake, Mauna Ulu
09. Lava cascades, Mauna Ulu
10. Overflow from Mauna Ulu Crater
11. Fountains, cascades, Alae Mezzanine
12. Lava fall/cascades, Alae
13. Molten lava flow near Kalapana
14. Congealed lava flow near Kalapana
15. Skylight above Kalapana
16. Lava fall into Pacific
17. Toe of lava flow, Kaena Point
18. Lava enters sea, Mauna Ulu
19. Lava bubble bursts in seawater
20. Pillow lava off Kealakomo

739007. Mount Pinatubo, Philippines: June 1991 Eruptions

01. Aerial view of area devastated by the April 2 explosions
02. Aerial view of the April 2 explosion craters
03. Close-up of the April 2 explosion craters
04. Geologists examine ash deposits from the April 2 eruption
05. June 12 eruption cloud from Clark Air Base
06. View of the June 12 eruption cloud
07. View of major eruption cloud on June 15
08. Aerial view of Pinatubo crater after major eruption
09. Aerial view Pinatubo pyroclastic deposits
10. Aerial view of small explosion in Pinatubo crater
11. Aerial view of Crater Lake
12. Effects of ash fall on plane
13. Effects of ash fall at Clark Air Base
14. Effect of ash fall on native hut
15. Resettlement camp
16. Aerial view of valley filled with mudflows
17. Scientists observe a hot mudflow

18. Mudflow collapses bridges in Angeles City
19. Aerial view flooding in village
20. Satellite photos showing movement of aerosol cloud

739008. The Crater Peak (Mount Spurr), Alaska: Eruptions of 1992

01. View of Crater Peak and Mount Spurr before eruption
02. Warm lake within the Crater Peak basin prior to eruption
03. Steam rising from the Crater Peak vent
04. Damage to seismometer on Crater Peak from the June 27 eruption
05. The ash column from the August 18 eruption
06. Ash cloud rising off south flank of Crater Peak
07. South flank of Crater Peak showing bomb impact craters
08. New magma within the pyroclastic flow deposits
09. Inflated gneiss ejected in 1992
10. Successive pyroclastic avalanches
11. Geologist near one of bomb craters on south flank of Crater Peak
12. Fallout from tephra cloud deposited on the ground
13. The inside of Crater Peak after the August eruption
14. Fallout in Anchorage from the August 18 eruption cloud
15. Ash on the ground in Anchorage becomes resuspended
16. Clean-up at Anchorage International Airport
17. September eruption of Crater Peak
18. Lahars from the September eruption
19. The Crater Peak vent after the September eruption
20. Plume of gas from Crater Peak as seen from Anchorage

739009. Mount Pinatubo Revisited; A Study of Lahar Erosion

01. Recent lahar terraces and older lahar terraces
02. Ancient Pinatubo lahar outcrop
03. Older and recent pyroclastic flow deposits
04. Undisturbed flow front of the secondary pyroclastic flows, Pasig River, October 6, 1993
05. Areas affected by the secondary pyroclastic flows in the Abacan River, April 4, 1992
06. Lahars in the Sacobia River channel
07. Lahar deposits along the Mancatian Porac area
08. The Sacobia lahar channel along the Bamban area
09. Remnants of recent pyroclastic flows, along the Sacobia channel
10. View of the Sacobia lahar channel

11. Deeply incised pyroclastic flow deposit along the Sacobia River
12. Gravelly lahar terraces from debris flows
13. Dike along the Dolores in Mabalacat, constructed to protect villages from lahar encroachment
14. Restraining structures damaged and eroded by lahar flows
15. Capture point of the Abacan River and Sacobia River
16. Recent secondary pyroclastic flow deposit from secondary explosions which occurred in 1992
17. Damaged houses along the Abacan River channel
18. Church in Porac buried by avulsing lahars from the Pasig River
19. Clark Air Base Cinema after the 1991 eruption
20. Houses buried by lahars in Mancatian Porac

SLIDE01. Relief Globe Slides

01. 90 deg W (view centered on 45 deg N)
02. 0 deg E (view centered on 45 deg N)
03. 90 deg E (view centered on 45 deg N)
04. 180 deg E (view centered on 45 deg N)
05. 90 deg W (view centered on Equator)
06. 0 deg E (view centered on Equator)
07. 90 deg E (view centered on Equator)
08. 180 deg E (view centered on Equator)
09. 90 deg W (view centered on 45 deg S)
10. 0 deg E (view centered on 45 deg S)
11. 90 deg E (view centered on 45 deg S)
12. 180 deg E (view centered on 45 deg S)
13. North Pole
14. South Pole
15. World view, Mercator Projection
16. World view, Cylindrical Equidistant Projection
17. World view with earthquake epicenters
18. World view with crustal plate boundaries, earthquake epicenters
19. The “Pacific Ring of Fire”
20. Close-up view of plates and epicenters for the Americas

The National Geophysical Data Center

The National Oceanic and Atmospheric Administration (NOAA) collects, manages, and disseminates scientific data that result from environmental investigations. The National Geophysical Data Center (NGDC), one of the several data management centers of NOAA, is responsible for data activities in the fields of solid earth geophysics, marine geology and geophysics, paleoclimatology, and solar-terrestrial physics.

NGDC goals are to support science by acquiring and archiving data, processing and formatting data into standard sets, developing useful data products, and distributing data to the user community. Customers include the general public, data managers, and scientists in private industry, academia, and federal and state governments.

The Solid Earth Geophysics Division of NGDC supports many scientific and engineering endeavors in the fields of gravity, topography, seismology (including earthquake seismology, engineering seismology, and tsunami), ecosystems, geomagnetism (Earth-surface, airborne, and satellite data), geothermics, and geochemistry. Some of the services include:

- Standard and custom CD-ROM products
- Customized data retrieval and output
- Selective searches of data bases
- Technical reports, catalogs of data inventories
- Publication of selected reports for other organizations
- International data exchange
- Data systems for managing all types of geoscience data
- Data management and archival for special projects

NGDC welcomes inquiries, data contributions, and cooperative projects with other organizations. If you have data that you can contribute to NGDC without restriction, you may be eligible to receive similar data at no charge. More information, as well as access to much of our data, can be found on our web site at **http://www.ngdc.noaa.gov/.**

Many employees at the National Geophysical Data Center were involved in the preparation of the **Geologic Hazards Photos** compact disc set and the related access software:

Project authorization:	Allen M. Hittelman
Project management:	Susan J. McLean
Slide set preparation:	Patricia A. Lockridge, Stewart D. Racey
CD-ROM preparation:	Stewart D. Racey
GeoVu software:	Deborah Sinay, Ray E. Habermann
Documentation:	Patricia Lockridge, Stewart Racey, Susan McLean, Joy Ikelman

For more information about this product or others available from NGDC, please contact us at:

NOAA/National Geophysical Data Center
325 Broadway
Boulder, Colorado 80303, U.S.A.

Telephone: (303) 497-6277
Fax: (303) 497-6513
Email: info@ngdc.noaa.gov
Web: http://www.ngdc.noaa.gov