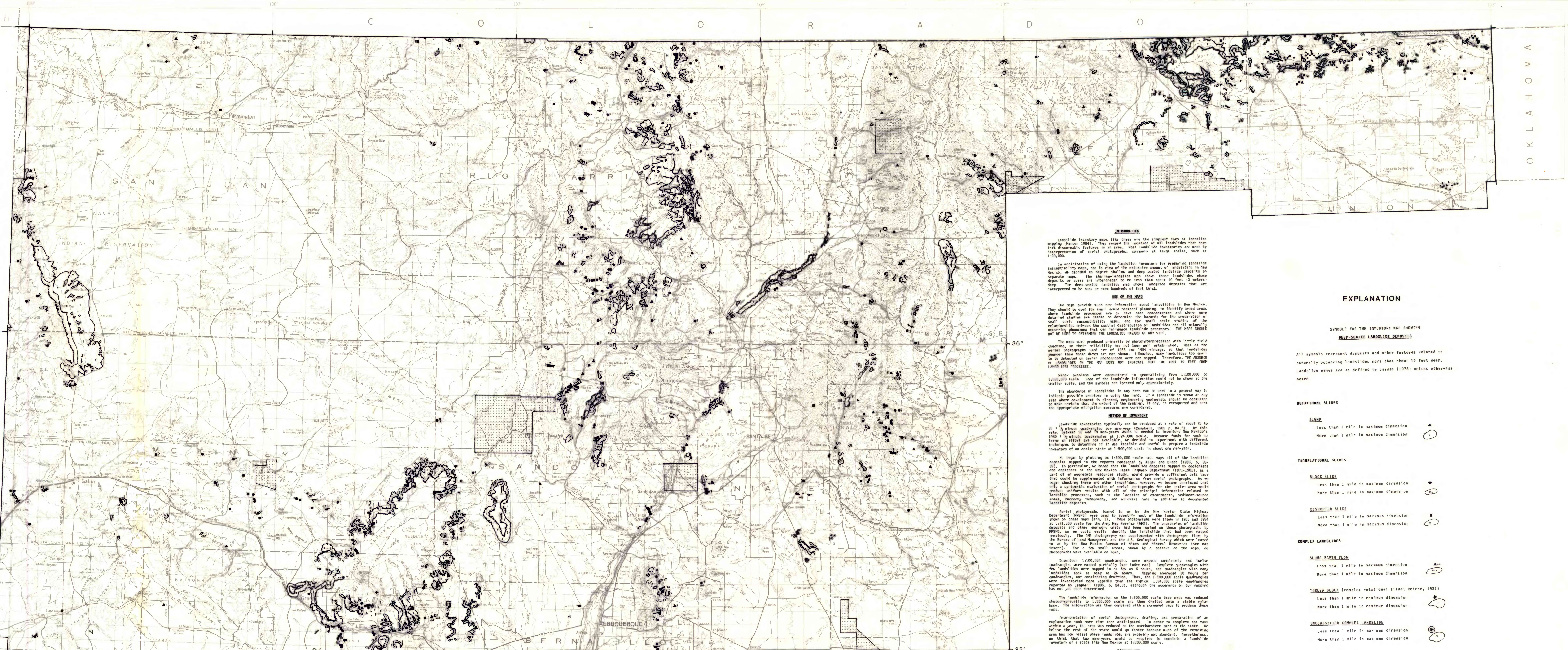
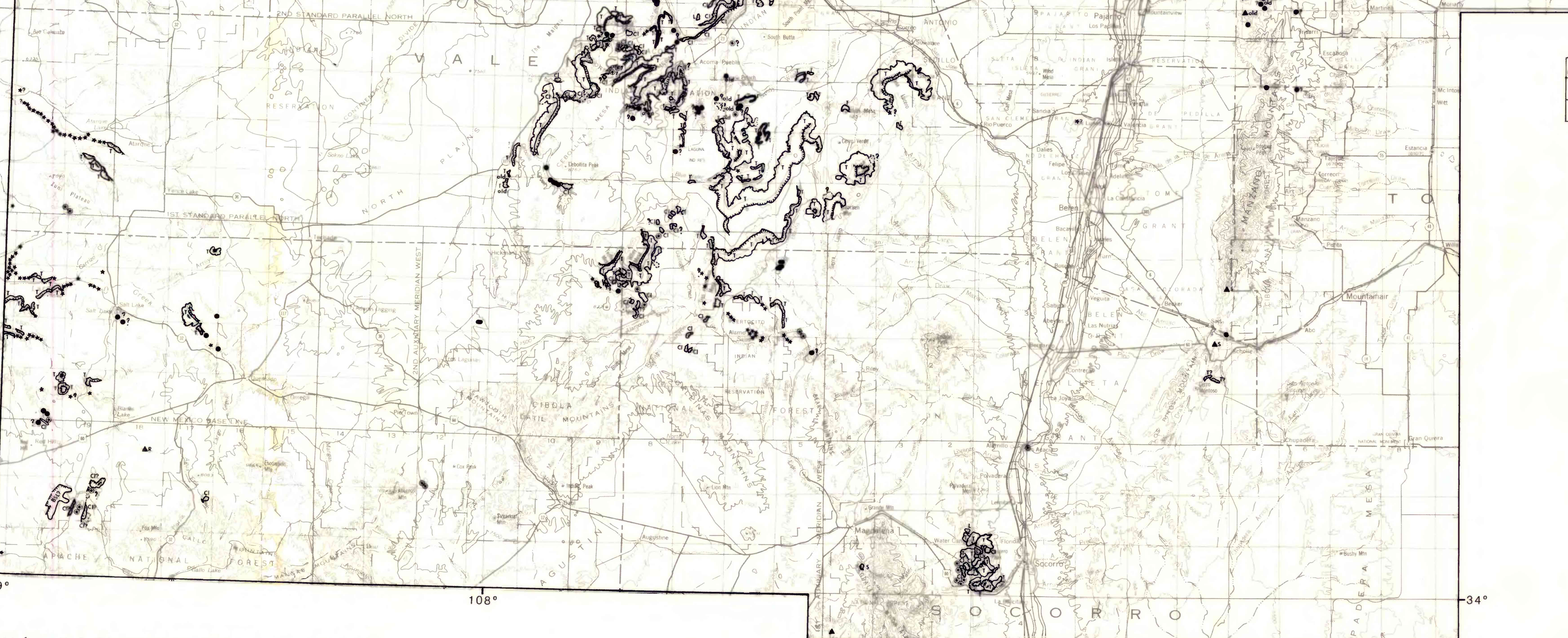
Prepared in cooperation with the
RESEARCH INSTITUTE FOR HYDROGEOLOGICAL PROTECTION IN CENTRAL ITALY
NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES
AND THE
NEW MEXICO STATE HIGHWAY DEPARTMENT

INTRODUCTION

Landslide inventory maps like these are the simplest form of landslide mapping (Hansen 1984). They record the location of all landslides that have left discernable features in an area. Most landslide inventories are made by interpretation of aerial photographs, commonly at large scales, such as 1:20,000.

In anticipation of using the landslide inventory for preparing landslide susceptibility maps, and in view of the extensive amount of landsliding in New Mexico, we decided to depict shallow and deep-seated landslide deposits on separate maps. The shallow-landslide map shows those landslides whose deposits or scars are interpreted to be less than about 10 feet (3 meters) deep. The deep-seated landslide map shows landslide deposits that are interpreted to be tens or even hundreds of feet thick.

USE OF THE MAPS

The maps provide much new information about landsliding in New Mexico. They should be used for small scale regional planning, to identify broad areas where landslide processes are or have been concentrated and where more detailed studies are needed to determine the hazard; for the preparation of small scale susceptibility maps; and for small scale studies of the relationships between the spatial distribution of landslides and all naturally occurring phenomena that can influence landslide processes. THE MAPS SHOULD NOT BE USED TO DETERMINE THE LANDSLIDE HAZARD AT ANY SITE.

The maps were produced primarily by photointerpretation with little field checking, so their reliability has not been well established. Most of the aerial photographs used are of 1953 and 1954 vintage, so that landslides younger than these dates are not shown. Likewise, many landslides too small to be detected on aerial photographs were not mapped. Therefore, THE ABSENCE OF LANDSLIDES ON THE MAP DOES NOT INDICATE THAT THE AREA IS FREE FROM LANDSLIDES PROCESSES.

Minor problems were encountered in generalizing from 1:100,000 to 1:500,000 scale. Some of the landslide information could not be shown at the smaller scale, and the symbols are located only approximately.

The abundance of landslides in any area can be used in a general way to indicate possible problems in using the land. If a landslide is shown at any site where development is planned, engineering geologists should be consulted to make certain that the extent of the problem, if any, is recognized and that the appropriate mitigation measures are considered.

METHOD OF INVENTORY

Landslide inventories typically can be produced at a rate of about 25 to 35 7 1/2 minute quadrangles per man-year (Campbell, 1985 p. B4.3). At this rate, between 56 and 79 man-years would be needed to inventory New Mexico's 1980 7 1/2 minute quadrangles at 1:24,000 scale. Because funds for such so large an effort are not available, we decided to experiment with different techniques to determine if it was feasible and useful to prepare a landslide inventory of an entire state at 1:500,000 scale in about one man-year.

We began by plotting on 1:100,000 scale base maps all of the landslide deposits mapped in the reports mentioned by Alger and Brabb (1985, p. 68-69). In particular, we hoped that the landslide deposits mapped by geologists and engineers of the New Mexico State Highway Department (1971-1981), as a part of an aggregate resources study, would provide a sufficient data base that could be supplemented with information from aerial photographs. As we began checking these and other landslides, however, we became convinced that only a systematic evaluation of aerial photographs for the entire area would produce uniform results with all of the principal information related to landslide processes, such as the location of escarpments, sediment-source areas, hummocky topography, and alluvial fans in addition to documented landslide deposits.

Aerial photographs loaned to us by the New Mexico State Highway Department (NMSHD) were used to identify most of the landslide information shown on these maps (Fig. 1). These photographs were flown in 1953 and 1954 at 1:31,500 scale for the Army Map Service (AMS). The boundaries of landslide deposits and other geologic units had been marked on these photographs by NMSHD, so we could easily identify the landlslide that had been mapped previously. The AMS photography was supplemented with photographs flown by the Bureau of Land Management and the U.S. Geological Survey which were loaned to us by the New Mexico Bureau of Mines and Mineral Resources (see map insert). For a few small areas, shown by a pattern on the maps, no photographs were available on loan.

Seventeen 1:100,000 quadrangles were mapped completely and twelve quadrangles were mapped partially (see index map). Complete quadrangles with few landslides were mapped in as few as 6 hours, and quadrangles with many landslides took as many as 24 hours. Mapping averaged 18 hours per quadrangles, not considering drafting. Thus, the 1:100,000 scale quadrangles were inventoried more rapidly than the typical 1:24,000 scale quadrangles reported by Campbell (1985, p. B4.3), although the accurancy of our mapping has not yet been determined.

The landslide information on the 1:100,000 scale base maps was reduced photographically to 1:500,000 scale and then drafted onto a stable mylar base. The information was then combined with a screened base to produce these maps.

Interpretation of aerial photographs, drafing, and preparation of an explanation took more time than anticipated. In order to complete the task within a year, the area was reduced to the northwestern part of the state. We belive the rest of the state would go faster because much of the remaining area has low relief where landslides are probably not abundant. Nevertheless, we think that two man-years would be required to complete a landslide inventory of a state like New Mexico at 1:500,000 scale.

TERMINOLOGY

Landslide names used in this report follow the usage of Varnes (1978) unless otherwise noted, except that we use the term "LANDSLIDE" to encompass all types of slope movement designated on the maps.

ACKNOWLEDGEMENTS

We are grateful to Warren T. Bennett of the New Mexico State Highway Department, who loaned us most of the aerial photographs used to make the maps. He also provided a complete set of geologic maps at 1:190,000 scale used in making an aggregate survey for the State. Gary D. Johnpeer, Jo Anne C. Osburn and David W. Love of the New Mexico Bureau of Mines and Mineral Resources kindly loaned us several photographs, provided transportation to check a few of the landslide areas and reviewed the map and explanation. Stephen D. Ellen's comments on the explanation were very helpful. Most of all, we are grateful to Prof. Lucio Ubertini, Director of the Research Institute for Hydrogeological Protection in Central Italy, for providing the opportunity and funds for Guzzetti to work in the United States on this project.

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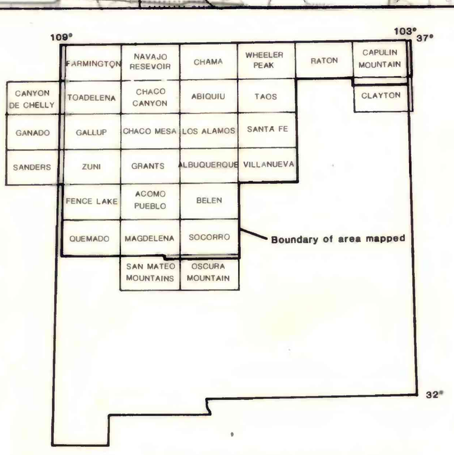
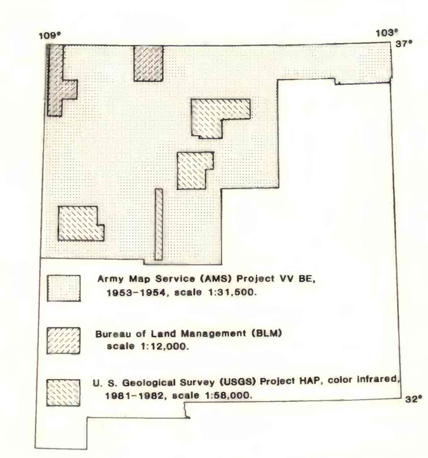


Index map showing 1:100,000 quadrangles used in preparing landslide maps.



Aerial photographs used in preparing landslide maps.

EXPLANATION

SYMBOLS FOR THE INVENTORY MAP SHOWING
DEEP-SEATED LANDSLIDE DEPOSITS

All symbols represent deposits and other features related to naturally occurring landslides more than about 10 feet deep. Landslide names are as defined by Varnes (1978) unless otherwise noted.

ROTATIONAL SLIDES

SLUMP
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

TRANSLATIONAL SLIDES

BLOCK SLIDE
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

DISRUPTED SLIDE
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

COMPLEX LANDSLIDES

SLUMP EARTH FLOW
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

TOREVA BLOCK (complex rotational slide; Reiche, 1937)
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

UNCLASSIFIED COMPLEX LANDSLIDE
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

UNCLASSIFIED LANDSLIDES
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

AREA WITH MORE THAN ONE KIND OF LANDSLIDE
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

HUMMOCKY TOPOGRAPHY of possible landslide origin
- Less than 1 mile in maximum dimension
- More than 1 mile in maximum dimension

AREA NOT MAPPED

BOUNDARY OF LANDSLIDE. Dashed line indicates that boundary is approximately located.

SCARP OF LANDSLIDE. May bound a landslide deposit. Hatcheres point towards the landslide deposit.

A number near the symbol indicates the number of features covered by the symbol itself.

A question mark "?" indicates uncertainty about the identification of the feature as a landslide.

"Old" next to a landslide symbol or a landslide area indicates that the landslide features are subdued by erosion and/or covered with vegetation, suggesting that the features formed long ago.

Base from U. S. Geological Survey state map, 1985 edition.

Landslides plotted from aerial photographs by Fausto Guzzetti and Earl E. Brabb in 1985-1986.

NOTE

THIS MAP SHOULD NOT BE USED TO DETERMINE THE LANDSLIDE HAZARD AT ANY SITE.

Scale 1:500,000
1 inch equals approximately 8 miles

This report is preliminary and has not been reviewed for conformity with Geological Survey editorial standards and stratigraphic nomenclature.

DEEP-SEATED LANDSLIDE DEPOSITS

MAP SHOWING LANDSLIDE DEPOSITS IN NORTHWESTERN NEW MEXICO

By

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1987