

EARTHQUAKE CATALOG OF PENNSYLVANIA

Metadata:

GENERAL INFORMATION

Citation Information:

Compiler: Faill, R. T.

Year of release: 2004

Title: Earthquake Catalog and Epicenter Map of Pennsylvania

Publisher: Pennsylvania Geological Survey

Series and number: Map 69

Media: CD-ROM

Summary:

The earthquake catalog of Pennsylvania resides in a Microsoft Access database. It is a compilation of 437 recorded seismic events in the Mid-Atlantic region of the United States whose epicenters (position on the earth's surface directly above the focus of the event) lie within or near Pennsylvania. Of these, 420 are considered to be earthquakes, and 17 are known or strongly suspected to be mine collapses or quarry blasts. For each record, the database contains 30 fields, which include location of the epicenter (latitude and longitude, as well as county and town), date, time, event strength (magnitude and intensity), depth of focus, source(s) of the event data, and ancillary remarks. The time span of seismic events is from 1724 to July 31, 2003.

The purpose of the database is to provide a single digital compilation of all recorded seismic events in and near Pennsylvania. The bounding latitudes are 39.25 to 42.5 degrees, and the bounding longitudes are -81.25 to -74.25 degrees.

The data are presented in a database in Microsoft Access format (versions 97 and 2000):

eqpa.mdb is 440 kilobytes in size.

eqpa97.mdb is 306 kilobytes in size.

For those who do not have the use of Microsoft Access, the earthquake events and references tables are provided in dBase IV (DBF) format. Files in this format can be imported into most database and spreadsheet software.

The earthquake events and references tables of the Access database have been formatted as page-sized reports and are provided in PDF files.

Contact Information:

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HISTORY OF DEVELOPMENT

The compilation of the database (eqpa.mdb) of seismic events was started by Rodger T. Faill of the Pennsylvania Geological Survey in 1997. The database was periodically updated during the next several years. The final update prior to publication was in late 2003, which made the database current to July 31, 2003. The events were compiled from a number of published and unpublished sources, which are listed in the [references](#).

SOURCES OF DATA

The events were compiled from many earthquake catalogs, periodicals, and publications. These sources are listed in the references table of the Access database, and are also provided as a text in PDF format (see [references](#)).

Some of the events appear in only one source; others (generally events of larger magnitude) appear in several sources. All reported events in the cited sources are listed in this catalog for the sake of inclusiveness. It is left to the users to winnow the list to suit their own purposes.

Accuracy of location varies greatly throughout the catalog. The uncertainty is largest for the pre-instrumental events, especially the oldest ones. The accuracy in general improves with the more recent events. No estimates of location accuracy are provided because such data are sparse for most events. The number of decimal places in many latitude and longitude values implies a precision that is unwarranted (for example, 0.001 degree is approximately 100 meters, which is perhaps an order of magnitude less than the size of the focal slip surface). However, the number of decimal places may simply be an artifact of software formatting.

FORMAT**1. Earthquake events table**

The earthquake events table in the database includes all the data characterizing each seismic event; it contains 30 fields and 437 records. The database was last modified in

June 2004. The following attributes (fields in the database) are provided (if known) for each event:

- the year, month, and day (and hour, minute, and seconds where known);
- whether the event was a main event, foreshock, or aftershock, and if it was a single event or part of a swarm;
- the latitude and longitude of the epicenter, as well as the nearest town or other location, county, and state or province;
- the magnitude, along with the type of magnitude calculation and station, the intensity, and the depth of focus;
- the number of events that share the same map number, and, if more than one, the dates of the other events;
- the mean latitude and longitude of events, based on the number of events that share the same map number; and the maximum magnitude associated with each map number
- reference citations and assorted miscellaneous comments.

The field names are listed below. The characteristics of each attribute/field are described in detail:

EVENT_NO: The event number is a unique number followed by the letter “e,” which is assigned to each event in order of date and time. It is used primarily for internal correlation (e.g., as a “relate” item for linking to the attribute table in the coverage).

DATE: The year, month, and day of the seismic event. The time of the event is given in Coordinated Universal Time (UTC), so the listed date may differ from the local date. The dates range from 1724/08/16 to 2003/07/17 and are current to July 31, 2003.

HR: The hour of the day the event occurred, in UTC.

MIN: The minutes past the hour of the day the event occurred, in UTC.

SEC: The seconds past the minute of the hour of the day the event occurred, in UTC. Precision is up to two decimal places.

MAP_NO: The map number refers to a specific location on the epicenter map included in this publication. Events that have identical locations (and those too proximal to each other to show separately on the 1:750,000-scale map) are assigned the same map number.

The events are separated into five groupings based on whether the event location was determined from newspaper accounts, damage-intensity surveys, or other noninstrumental means (arbitrarily pre-1966), or by seismic instruments (arbitrarily post-1965); whether the epicenter lies inside Pennsylvania, or outside (but still nearby) Pennsylvania; and whether an event has a nonnatural seismic cause (mine collapse or quarry blast).

The numbering system is as follows: 1 to 58—earthquakes since 1965 within Pennsylvania; 100 to 206—earthquakes since 1965 outside Pennsylvania; 500 to 530—earthquakes before 1966 within Pennsylvania; 700 to 727—earthquakes before 1966 outside Pennsylvania; and 900 to 907—nonnatural seismic events (mine collapse or quarry blast). The first two groups include some pre-1966 events in areas where two or more events that occurred in the same location or in close proximity have been combined and assigned the same map number.

F/A: Designation as a main event, a foreshock, an aftershock, or a nonnatural seismic event. For a swarm, main-event status (M) is assigned to the event having the largest

magnitude; events preceding M are designated as foreshocks (F), and those following M as aftershocks (A). The letter Q is used to indicate a mine collapse or quarry blast.

SWARM: Designation of whether an event is part of an earthquake swarm. The term “swarm” is herein used for a group of events having identical or proximal locations that occurred within a short period of time. Swarm designation is not precise. The span of locations varies from swarm to swarm. The time period may be minutes or hours to months. A swarm has a main event and may have one or more foreshocks and/or aftershocks. Attribute values are as follows: an event date (e.g., 1939/11/26)—indicates that the event is part of a swarm and the date is that of the main event of the swarm; single—the event is not part of a swarm; quarry blast—the event is nonnatural, caused by a quarry blast; and mine collapse—the event is nonnatural, caused by a mine collapse.

LAT: Latitude, in decimal degrees. The domain is from 39.25 to 42.5 degrees, and the maximum resolution is 0.001 degree (approximately 100 meters).

LONG: Longitude, in decimal degrees. The domain is from -81.25 to -74.25 degrees, and the maximum resolution is 0.001 degree (approximately 100 meters).

MAGN: Magnitude (Richter scale) of seismic event. Reported magnitudes range from 0.4 to 5.1.

MTYPE: Method by which magnitude was calculated. Attribute values are as follows:

lg: magnitude calculation using the Lg wave (Love and Raleigh waves)

mb: compressional body wave (P-wave) magnitude (Nuttli)

mbLg: body-wave magnitude using the Lg wave (Nuttli)

Mc: magnitude calculated from the coda duration

ML: local (“Richter”) magnitude

Mn: Nuttli magnitude

UK: stated in the source that the computational method was unknown

The symbols given for the same method vary among the original references but are simplified herein: **mb** for mb, MB, Mb, and Mfa; **mbLg** for mbLg and mblg; **Mc** for Mc, MD, MC, and mc; and **Mn** for Mn, MN, and MBN.

SOURCE: The seismic station at which the magnitude was calculated. Attribute values are as follows:

BLA: Virginia Tech Seismic Observatory (Blacksburg, Va.)

GS: U.S. Geological Survey

LDO: Lamont-Doherty Geological Observatory (Palisades, N. Y.)

NED: Delaware Geological Survey (Newark, Del.)

OTT: Geological Survey of Canada (Ottawa, Ontario)

PAL: Lamont-Doherty Geological Observatory (Palisades, N. Y.)

SCP: The Pennsylvania State University (State College, Pa.)

SLM: St. Louis University (St. Louis, Mo.)

WES: New England Seismic Network (Weston, Mass.)

INT: Felt Intensity, a semiquantitative measure of surface-shaking effects of an earthquake (modified Mercalli scale of 1931), with values ranging from I (not felt except by very few under especially favorable conditions) to XII (damage total, objects thrown into the air). In this catalog, intensities range from I to VII (slight damage in well-built ordinary structures, some chimneys broken).

DOF: Depth of earthquake focus (the center of earthquake movement and energy release), in kilometers. In this catalog, the range is 0.1 to 24 km.

MLAT: The mean latitude of events sharing a map number, in decimal degrees. For single events, the mean latitude is identical to the latitude (LAT). The epicenter point locations on the 1:750,000-scale map included in this publication were digitally generated from MLAT and MLONG values.

MLONG: Mean longitude of events sharing a map number, in decimal degrees. For single events, the mean longitude is identical to the longitude (LONG). The epicenter point locations on the 1:750,000-scale map included in this publication were digitally generated from MLAT and MLONG values.

MMAG: The maximum magnitude of events sharing a map number. For single events, the maximum magnitude is identical to the magnitude (MAGN).

LOC: Town, city, or other geographic location that is nearest to the epicenter.

CNTY: County in which the epicenter is located.

ST: State or province in which the epicenter is located. Abbreviations are as follows: DE—Delaware; MD—Maryland; NJ—New Jersey; NY—New York; OH—Ohio; ON—Ontario; PA—Pennsylvania; and WV—West Virginia.

NO_EVTS: The number of events that share the same map number.

OTHER: List of the other events by date that have the same map number as the entry. Where a range of dates is given, some of the dates in the range may apply to other map numbers. The attribute “none” indicates that there are no other shared events.

REF1: One of six fields showing the reference citation(s) for the source(s) of the data. Citations are not listed in any particular order, and there may be more than one in each field. Refer to the references table of the database or to [references](#) for bibliographic information pertaining to each citation.

REF2: See REF1 above.

REF3: See REF1 above.

REF4: See REF1 above.

REF5: See REF1 above.

REF6: See REF1 above.

REM: Miscellaneous remarks garnered from the listed references and personal communications to indicate the variability of values for a specific earthquake event.

2. Eqmapdata table

The “eqmapdata” table in the database contains six fields from the earthquake events table: MAP_NO, DATE, NO_EVTS, MLAT, MLONG, and MMAG. This table shows the 232 earthquake events that were used to generate the locations of epicenters shown on the map included in this publication. This condensation from the 437 records in the earthquake events table is necessary to portray the event locations at the 1:750,000 scale of the map without undue clutter and overprinting. The field definitions are identical to the equivalent fields in the earthquake events table. The dates in the DATE field represent those events having the maximum magnitude among events sharing each map number (MAP_NO). If more than one event has the maximum magnitude, the event having the oldest date is listed.

3. References table

The references table in the database contains five fields: CATALOG, AUTHOR, YEAR, TITLE, and PUBL. This table contains 127 records for all the source documents cited in

the reference and remarks fields in the earthquake events table and includes a few related sources that were not cited. The fields are described below:

CATALOG: The abbreviation used in the six reference fields and the remarks field for citation of earthquake catalogs.

AUTHOR: The author(s) of each publication.

YEAR: The year the document was published. For catalogs and other documents accessed on web sites, the year field indicates the year in which the web site was accessed by the author if (1) no year of publication was indicated or (2) the information on the site is updated at intervals and thus does not have a static date.

TITLE: The title of the publication.

PUBL: The publisher of the document, publication series, and other pertinent bibliographic information. For on-line sources, the URL of the web site is provided. All web links were correct as of June 21, 2004.

DISTRIBUTION LIABILITY AND ACCESS CONSTRAINTS

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