Data structure for DI-20: Digital geographic index of geologic literature for the east half of the Phoenix North 30' x 60' quadrangle, Arizona

by
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Text to accompany DI-20

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INTRODUCTION

This document describes the database structure of Arizona Geological Survey Digital Information Series DI-20, Digital geographic index of geologic literature for the east half of the Phoenix North 30' x 60' quadrangle, Arizona. DI-20 is a georeferenced bibliography that allows the user to conduct spatial and keyword searches to locate geologic information about the east half of the Phoenix North 30' x 60' quadrangle.

The purpose of this document is to provide a written description of the procedures used to create the dataset, and the structure of the dataset. It is assumed that the reader is familiar with geographic databases and the use of Arc/Info and ArcView GIS software.

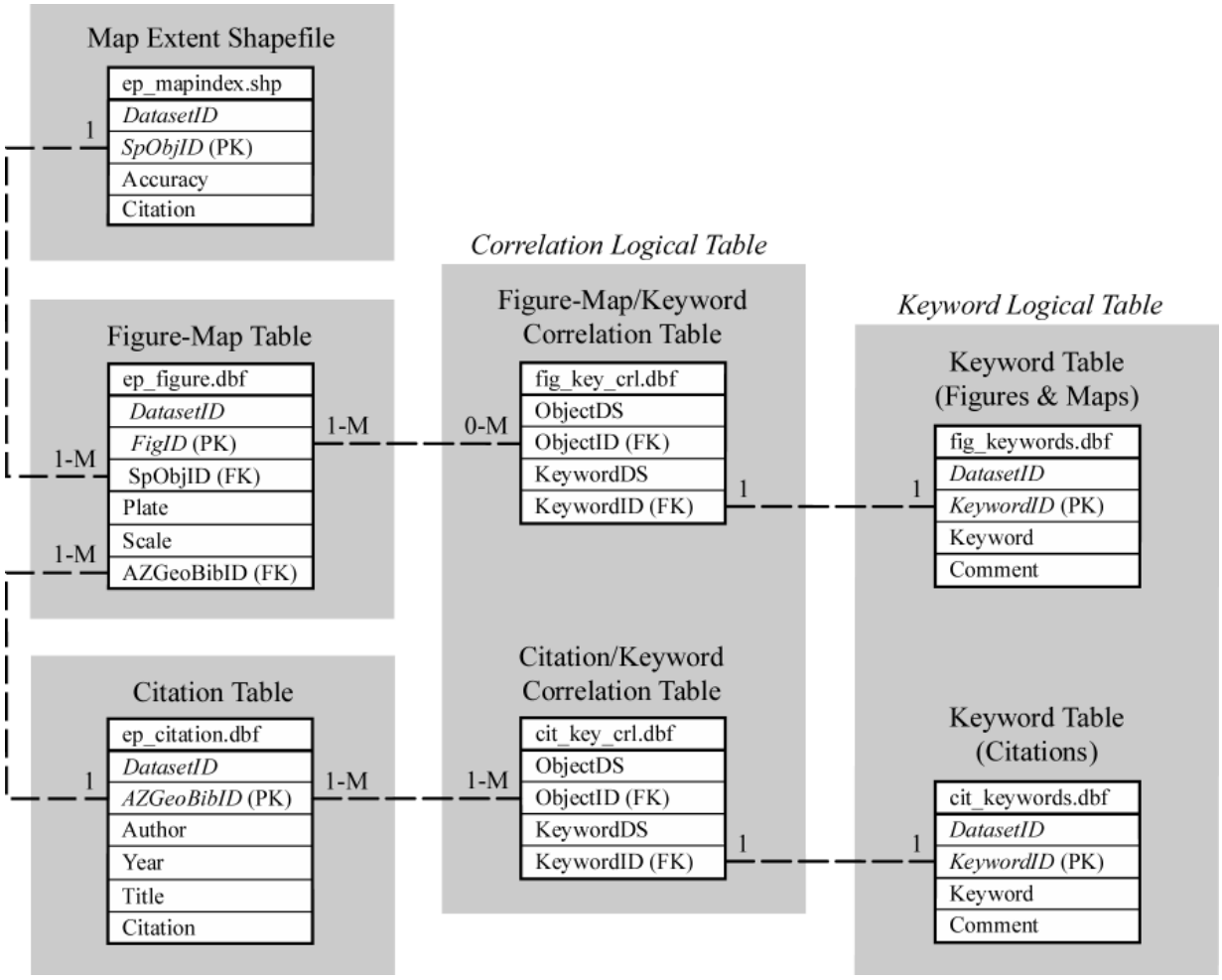

Figure 1. Map data model showing the structure of the tables that comprise this database. Each box represents a data table or correlation table, with the lines linking primary keys (PK) and foreign keys (FK). The compound primary keys are shown in italics. Cardinality labels where a line meets a table indicate the number of rows in that table for which the linked field matches a value in the corresponding field of the linked table; '1' = one and only one; '1-M' = at least one; '0-M' = 0 to many. In a standard database there would only be one keyword table and one correlation table, but, due to implementation problems in ArcView GIS, it was necessary to create separate keyword tables and separate correlation tables. Each pair of tables, however, can be thought of as a single logical table. This is represented by the shaded boxes which show logical table groupings.

Table 1. Shapefile and data table summary. Field definitions are in parentheses. I is an integer field, C is a character field, and the number indicates the field width.

Shapefile/Table	Attributes	Description
azcounty.shp	Name (C,16)	Polygon shapefile defining the spatial extents of counties in Arizona for location reference.
ep_mapindex.shp	DatasetID (I,16) SpObjID (I,16) Accuracy (I,8) Citation (C,254)	Polygon shapefile defining the spatial extents of the maps and figures.
ep_outline.shp	Name (C,32)	Polygon shapefile defining the spatial extent of the east half of the Phoenix North quadrangle.
ep_citation.dbf	DatasetID (I,16) AZGeoBibID (I,16) Author (C,254) Year (I,8) Title (C,254) Citation (C,254)	Table lists the citations that describe the geology of project area.
ep_figure.dbf	DatasetID (I,16) FigID (I,16) SpObjID (I,16) Plate (C,64) Scale (I,8) AZGeoBibID (I,16)	Table lists figures and maps digitized and correlates the citation table with the map index shapefile.
cit_keywords.dbf	DatasetID (I,16) KeywordID (I,16) Keyword (C,32) Comment (C,254)	Table lists the keywords associated with the citations table.
fig_keywords.dbf	DatasetID (I,16) KeywordID (I,16) Keyword (C,32) Comment (C,2545)	Table lists the keywords associated with the figures table.
cit_key_crl.dbf	ObjectDS (I,16) ObjectID (I,16) KeywordDS (I,16) KeywordID (I,16)	Table correlates the citation keywords with the citation table.
fig_key_crl.dbf	ObjectDS (I,16) ObjectID (I,16) KeywordDS (I,16) KeywordID (I,16)	Table correlates the figure keywords with the figure table.

DATA COLLECTION AND DIGITIZING PROCEDURES

This dataset was compiled by filtering pertinent spatial data from Arizona Geological Survey DI-9, Arizona Geologic Index Map (Kneale and Richard, 1998), and adding additional information located through extensive literature searches. The bibliographies searched to gather this additional information included AZGEOBIB (Trapp et. al., 1995), GeoRef, and the online library catalogs for the University of Arizona, Arizona State University, and Northern Arizona University. In addition, the citation sections from several pertinent publications were perused for additional useful references. The complete bibliography for this database is included in Appendix A.

Most spatial extents were digitized from paper copies of maps or publication figures using Arc/Info v.7.1.1 and a Calcomp Drawingboard II table digitizer. Where possible, spatial extents were digitized directly on screen using DRG's or other digital maps as guides. In some cases, polygon extents were copied from other digital sources.

The maps and figures were projected in ArcView 3.2 to UTM, zone 12, NAD1927 coordinates, with map units in meters. Additional tables were created using ArcView v.3.2 and Microsoft Excel 2000. The metadata was written using the MetaData Collection Tool v2.0, an ArcView script written by the NOAA Coastal Services Center, and the TK Metadata Editor by Peter Schweitzer of the USGS in Reston, VA.

DATA ORGANIZATION

This geographic database is designed to operate as a georeferenced geologic bibliography that can be searched both spatially and through the use of keywords. A data model schema, outlining the shapefile and database table relationships for the geospatial objects and the data tables, is shown in Figure 1. The data fields included in these tables are summarized in Table 1.

The spatial information in this geographic database is contained in three ArcView shapefiles. The map index shapefile, **ep_mapindex.shp**, is composed of polygons that define the spatial extents of the maps and figures that correlate bibliographic citations with geographic areas. The counties shapefile, **azcounty.shp**, contains polygons representing the counties in Arizona, and the map area shapefile, **ep_outline.shp**, contains the polygon representing the east half of the Phoenix North 30' x 60' quadrangle. The counties shapefile and the map area shapefile are included as location references and are not included as part of the data model in Figure 1.

The citation table, **ep_citation.dbf**, contains the list of citations that describe the geology of project area. The figures table, **ep_figure.dbf**, lists the figures and maps digitized and correlates the citation table with the map index shapefile. As shown in Figure 1, each citation is associated with one to many figures, while each figure is associated with only one citation. Each figure has a unique map extent but several figures may share the same map extent. Thus a 'many to many' relationship exists between the map extent shapefile and the citation table.

Keywords are located in two tables, **fig_keywords.dbf** and **cit_keywords.dbf**. In an ideal database, there would only be one keyword table. However, due to implementation problems with ArcView GIS 3.2, it was necessary to split the keywords into two separate tables. The keywords are then correlated with the figures table and the citations table using the **fig_key_crl.dbf** and **cit_key_crl.dbf** correlation tables, respectively. Again, due to implementation problems in ArcView GIS 3.2, it was necessary to create two separate correlation tables. These relationships, as shown in figure 1, also result in a 'many to many' relationship between citations and keywords, and between figures and keywords. Each citation or figure may have many linked keywords, and each keyword may be linked to many citations or figures.

Each data table record is uniquely identified by a compound primary key (italicized in Figure 1) that consists of a source-file identifier (DatasetID) and a unique record identifier within that file (SpObjID, FigID, AZGeoBibID, or KeywordID). Because the software used to implement this data model, ArcView GIS, can not join on a compound key, it is usually necessary to add a user-defined

'Joinkey' attribute - a concatenation of the source-file identifier and the unique record identifier - for every record in the implementation. However, since this database is relatively simple, it is possible to relate tables using only the unique record identifier.

SHAPEFILES

The shapefile below contains the spatial data for the geographic database of the east half of the Phoenix North quadrangle. This shapefile, and the fields included in its feature attribute table, is summarized in Table 1.

County Shapefile

The county shapefile (azcounty.shp) contains the polygons that define the spatial extents of the counties in Arizona to provide a location reference.

The shapefile attribute table contains one field.

- NAME: Character, width 16. Field contains the name of the county.

Map Extent Shapefile

The map extent shapefile (ep_mapindex.shp) contains the polygons that define the spatial extents of the maps and figures used correlate bibliographic citations with specific geographic areas.

The shapefile attribute table contains three fields.

- DATASETID: Integer, width 16. Field contains an integer value unique to the map index shapefile and is the first part of the compound primary key for each polygon. All polygons in the shapefile have the same value. Domain: 400.
- SPOBJID: Integer, width 16. Field contains an integer value unique to each feature in the map extent shapefile and is the second part of the compound primary key for each polygon. Each polygon has a different value. Domain: >0 and $<10^{16}$.
- ACCURACY: Integer, width 8. Field contains the estimated spatial uncertainty in the location of a polygon, in meters. For example, a value of 100 indicates that the boundary of the polygon is within 100 meters of its presumed location on the ground. A value of –1 indicates that the accuracy is not defined, as in the case where the location of a polygon is extrapolated from other information, such as a written description, rather than digitized from a map or figure. Domain: >numerical precision of data and $<10^{8}$, or –1.
- CITATION: Character, width 254. Field contains a concatenated list of the citations that are associated with each record. This field has been added to allow simple correlations to be made between each map extent and the list of citations in Appendix A, without having to create links between the map extent shapefile and the data and correlation tables.

Project Area Shapefile

The project area shapefile (ep_outline.shp) contains the polygon that defines the spatial extent of the east half of the Phoenix North 30' x 60' quadrangle.

The shapefile attribute table contains one field.

- NAME: Character, width 32. Field contains the name of the project area..

DATA TABLES

The data tables below describe the information associated with each spatial object in this database. These tables are summarized in Table 1.

Citation Table

The citation table (ep_citation.dbf) is a list of references for the publications and reports that describe the geology of east half of the Phoenix North 30' x 60' quadrangle.

The table contains six fields.

- DATASETID: Integer, width 16. Field contains an integer value unique to the citation table and is the first part of the compound primary key for each record in the table. All records have the same value. Domain: 4.
- AZGEOBIBID: Integer, width 16. Field contains an integer value unique to each record in the citation table and is the second part of the compound primary key for each record. Each record has a different value that corresponds to a citation in AZGEOBIB (Trapp et. al., 1995). Domain: >0 and $<10^{16}$.
- AUTHOR: Character, width 254. Field lists the authorship of each citation.
- YEAR: Character, width 254. Field contains the year of publication or completion for each citation.
- TITLE: Character, width 254. Field contains the citation title.
- CITATION: Character, width 254. Field contains all other information specific to each citation (e.g. publisher, volume number, page number...).

Figure Table

The figure table (ep_figure.dbf) is a list of the maps, figures, and other areas used to correlate citations with specific map extents.

The table contains six fields:

- DATASETID: Integer, width 16. Field contains an integer value unique to the figure table and is the first part of the compound primary key for each record in the table. All records have the same value. Domain: 404.
- FIGID: Integer, width 16. Field contains an integer value unique to each record in the figure table and is the second part of the compound primary key for each record. Each record has a different value. Domain: >0 and $<10^{16}$.
- SPOBJID: Integer, width 16. Foreign key to the 'SpObjID' field in the map extent shapefile.
- PLATE: Character, width 64. Field contains the page and figure number, the plate number, or sheet number for each figure and map. The locations of citations without figures, maps, or verbal location descriptors are determined from other citations with the same topic and are listed as having an extrapolated location.
- SCALE: Integer, width 8. Field contains the denominator of the map scale. For example, a value of 12000 indicates a map scale of 1:12,000. Domain: >0 and $<10^{8}$.
- AZGEOBIBID: Integer, width 16. Foreign key to the 'AZGeoBib' field in the citation table.

Citation Keywords Table

The citation keywords table (cit_keywords.dbf) lists the keywords used to describe the citations.

The table contains four fields.

- DATASETID: Integer, width 16. Field contains an integer value unique to the keywords dataset and is the first part of the compound primary key for each keyword record. All records in the table have the same value. Domain: 403.

- KEYWORDID: Integer, width 16. Field contains an integer value unique to each keyword in this dataset and is the second part of the compound primary key for each keyword record. Each record has a different value. Domain: >0 and $<10^{16}$.
- KEYWORD: Character, width 32. Field contains keywords used to describe the citations.
- COMMENT: Character, width 254. Field contains additional information pertinent to keywords (e.g. clarifications or definitions).

Figure Keywords Table

The figures keywords table (fig_keywords.dbf) lists the keywords used to describe the figures and maps

The table contains four fields.

- DATASETID: Integer, width 16. Field contains an integer value unique to the keywords dataset and is the first part of the compound primary key for each keyword record. All records in the table have the same value. Domain: 403.
- KEYWORDID: Integer, width 16. Field contains an integer value unique to each keyword in this dataset and is the second part of the compound primary key for each keyword record. Each record has a different value. Domain: >0 and $<10^{16}$.
- KEYWORD: Character, width 32. Field contains keywords used to describe the figures and maps.
- COMMENT: Character, width 254. Field contains additional information pertinent to keywords (e.g. clarifications or definitions).

CORRELATION TABLES

The tables below are used to correlate the keyword tables to the figure table and the citation table. These tables are summarized in Table 1.

Citation/Keyword Correlation Table

The citation/keyword correlation table (cit_key_crl.dbf) correlates keywords with citations.

The table contains four fields.

- OBJECTDS: Integer, width 16. Foreign key to the DatasetID field in the citation table.
- OBJECTID: Integer, width 16. Foreign key to the AZGeoBibID field in the citation table.
- KEYWORDDS: Integer, width 16. Foreign key to the DatasetID field in the citation keyword table.
- KEYWORDID: Integer, width 16. Foreign key to the KeywordID field in the citation keyword table.

Figure-Map/Keyword Correlation Table

The figure-map/keyword correlation table (fig_key_crl.dbf) correlates keywords with figures and maps.

The table contains four fields.

- OBJECTDS: Integer, width 16. Foreign key to the DatasetID field in the figure table.
- OBJECTID: Integer, width 16. Foreign key to the FigID field in the figure table.

- KEYWORDDS: Integer, width 16. Foreign key to the DatasetID field in the figure and maps keyword table.
- KEYWORDID: Integer, width 16. Foreign key to the KeywordID field in the figure and maps keyword table.

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APPENDIX A

BIBLIOGRAPHY OF GEOLOGIC LITERATURE FOR THE EAST HALF OF THE PHOENIX NORTH 30' X 60' QUADRANGLE, ARIZONA

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