Spatial Digital Database for the Geology of the San Pedro River Basin in Cochise, Gila, Graham, Pima, and Pinal Counties, Arizona

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Introduction

This spatial digital database for the geology of the San Pedro River Basin in southeastern Arizona was compiled from three maps by Dickinson (1993, 1998, 2000). Mylar originals of the map sheets were scanned, and the resultant images were rectified to a mathematically-generated set of latitude and longitude registration points. Geologic linework was digitized from the rectified images on screen using ArcView (ver. 3.2), and the resultant shapefiles were converted to ArcInfo (ver. 7.2) coverages. Lines and polygons were then attributed; and the files were merged omtp a single ArcInfo database (quib24k).

This digital spatial database is one of many being created by the U.S. Geological Survey as an ongoing effort to provide geologic information in a geographic information system (GIS) for use in spatial analysis. This database can be queried in many ways to produce a variety of geologic maps. Digital base map data files (topography, roads, towns, rivers and lakes, etc.) are not included: they may be obtained from a variety of commercial and government sources. This database is not meant to be used or displayed at any scale larger than 1:24,000 (for example, 1:12,000).

The map area is located in southeastern Arizona (fig. 1). This report describes the map units, the methods used to convert the geologic map data into a digital format, and the ArcInfo GIS file structures and relationships; and it explains how to download the digital files from the U.S. Geological Survey public access World Wide Web site on the Internet. See figures 2 and 3 for page-size versions of the map compilation.

Manuscript and digital data review by Helen Kayser is greatly appreciated.

Description of Map Units

Unit descriptions were adapted from Dickinson (1998), Dickinson (1993), and Dickinson (2000).

Qfa Floodplain alluvium of Gila and San Pedro river valleys, the modern axial streams of the San Pedro trough, and Aravaipa Creek (Holocene)

Qaf Alluvium (Holocene)—Tributary alluvial fans

Qtg Stream terrace gravels of San Pedro River (Quaternary)

Tcg Gravels of Camp Grant (Pliocene)—Unconsolidated to semi-consolidated gravels and locally sandy deposits, partial equivalent of Quiburis Formation

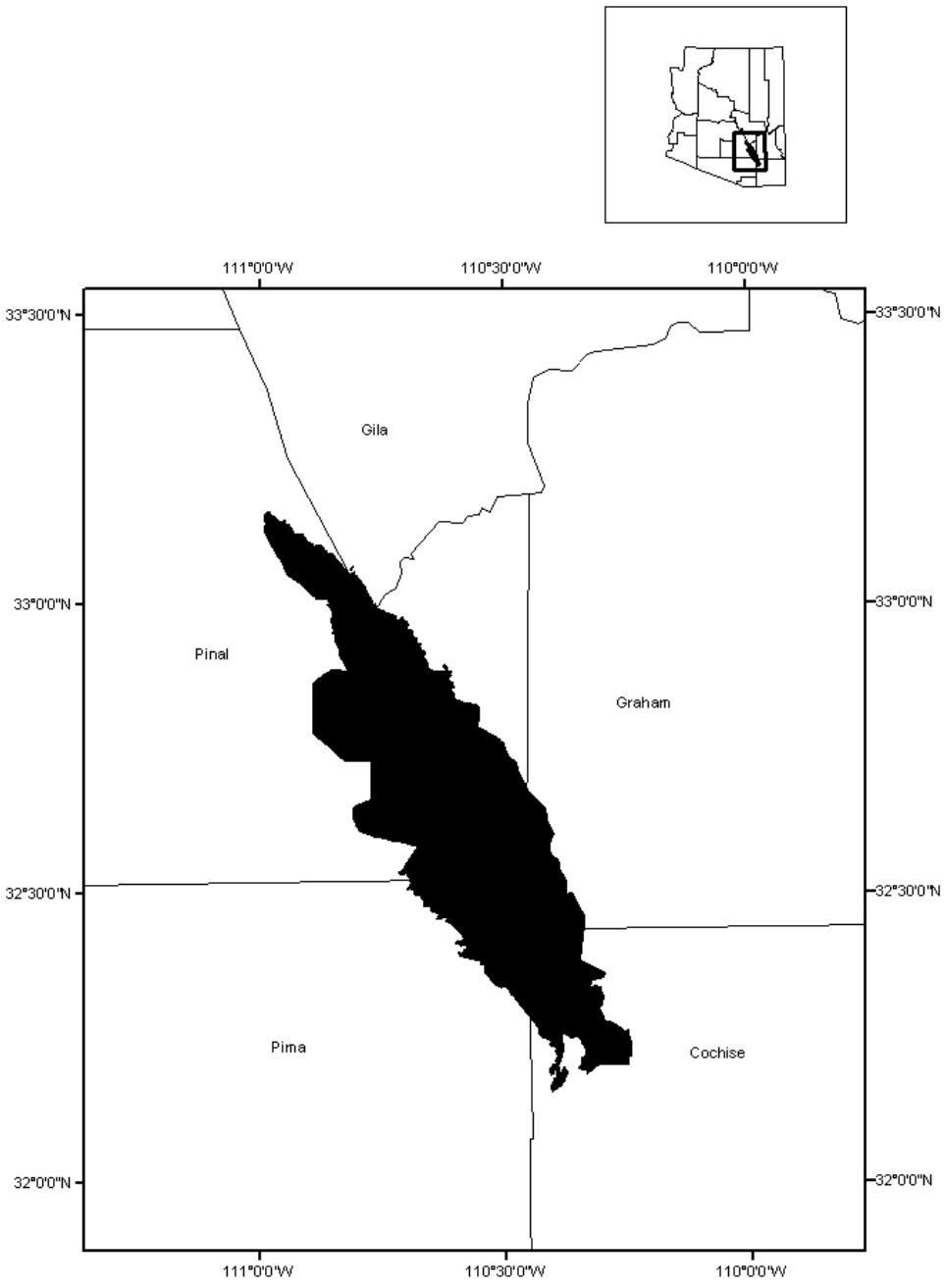

Figure 1. Index map showing the geographic extent of the spatial digital database (black fill) with respect to Arizona counties

Figure 2. Explanation for the simplified geologic map of the San Pedro River Basin, Arizona

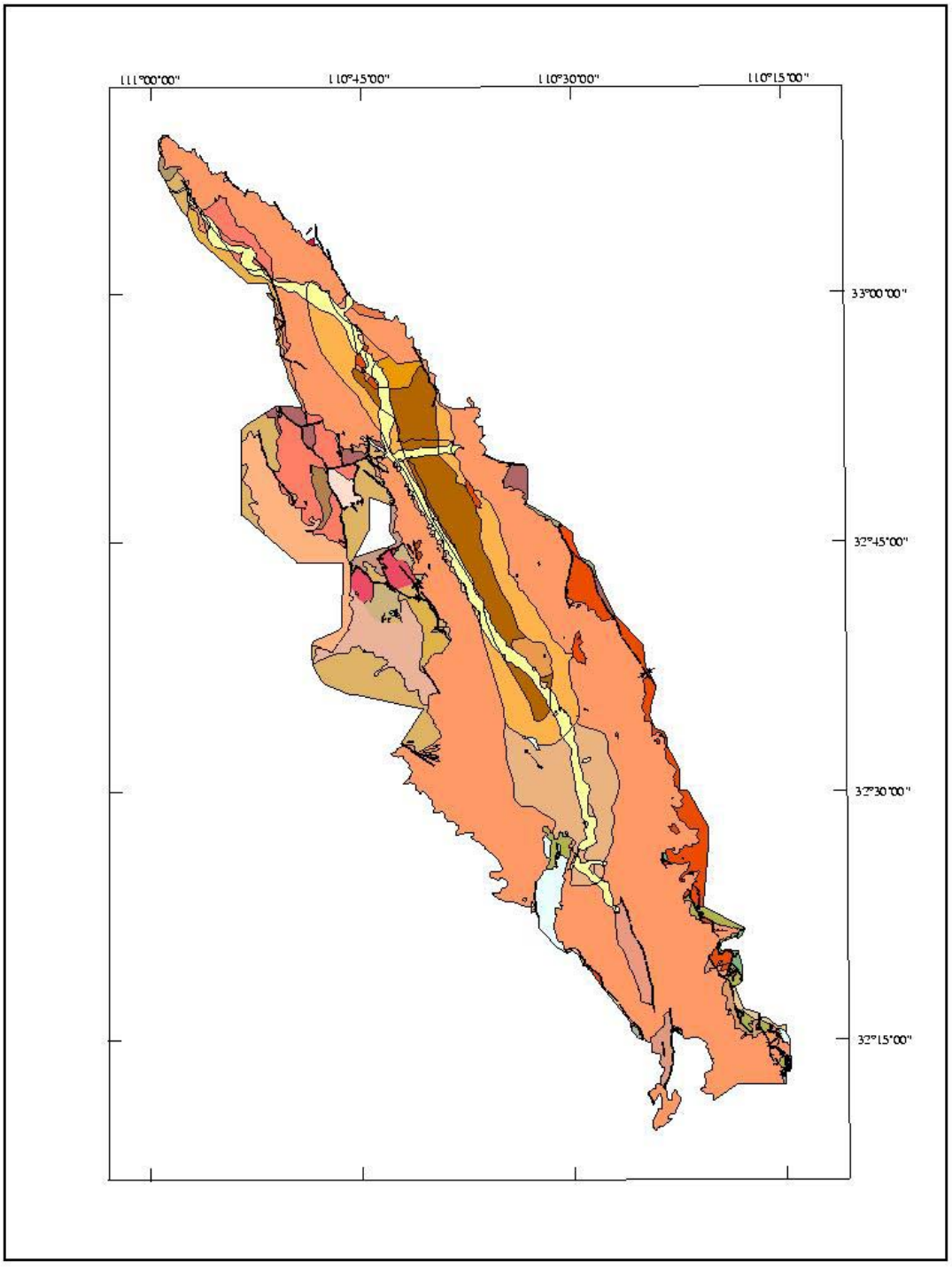

Figure 3. Simplified geologic map the San Pedro River Basin, Arizona.

Tq Quiburis Formation (Miocene-Pliocene)—Basin fill of San Pedro trough

Tqc Gravelly alluvial-fan and braidplain facies (Upper Miocene to Pliocene(?)—Massive to imbricated conglomeratic streamflood and minor debris-flow deposits which flank the central San Pedro trough (San Pedro segment), but occupy the full width of northern San Pedro trough (Gila segment) and of southern San Pedro trough (south of Redington), where paired piedmont fan subfacies flank axial fluvial subfacies not mapped separately).

Tqcr Rubbly bajada facies of the gravelly alluvial-fan and braidfacies (Tqc) of the Quiburis Formation

Tqs Sandy fan-toe, lake-margin, and delta-front sandflat facies—Massive to laminated sandstone with minor shale or mudstone interbeds and local thin pebble stringers which are intermediate in both grain size and depositional environment between laterally equivalent alluvial-fan/brainplain (Tqc) and lacustrine (Tql and Tqm) facies

Tqse Prominent delta-front subfacies of "Eskiminzin Delta"—Sandstone, locally pebbly, with multiple thin mudstone interbeds deposited where the axial fluvial system flowing to the southeast down the Gila segment of the San Pedro trough debouched into the axial lacustrine system of the San Pedro segment of the San Pedro trough near an array of partly buried tiltblocks that expose Galiuro Volcanics near Dudleyville

Tqsr Extensive alluvial plain subfacies ("Redington Member") of sandstone beds—Contains local pebble stringers and lenses, interbedded reddish mudstone partings, and dispersed pedogenic carbonate nodules. Represents the axial fluvial system occupying the San Pedro trough south of lacustrine-influenced facies (Tql and Tqm), which extend from the Gila River to the "Little Black Hills" near San Manuel

Tqsrg Area of 1-10 cm gypsum stringers in sandstone (Tqsr)

Tqm Massive prodelta mudstone—Deposited as a foredelta facies of "Eskiminzin Delta"

Tql Laminated lacustrine facies—Variably interbedded mudstone, limestone, gypsum, and diatomite with sparse and thin intercalations of laminated lacustrine sandstone

Tqld Diatomaceous facies of the laminated lacustrine facies (Tql) of the Quiburis Formation

Tsm San Manuel Formation (Lower Miocene)—Includes local areally restricted facies (Dickinson, 1991) south of Redington (lateral equivalence of the three southern facies is demonstrated by tongues of Tkse within Tspg as mapped by Dickinson along lower Paige Canyon, and tongues of Tspg within Tssz as mapped by Dickinson along lower Robles Canyon)

Tssz Soza Canyon facies—Volcaniclastic (Galiuro Volcanics clasts)

Tspg Paige Canyon facies—Metamorphiclastic (Laramide metamorphite clasts)

Tske Kelsey Canyon facies—Plutoniclastic (Johnny Lyon Granodiorite clasts)

Tbw Beehive Well member—Well-bedded to laminated interval of sandstone and conglomeratic sandstone forming medial stratigraphic horizons within San Manuel Formation on the downthrown side of the Cowhead Well Fault

Tsmb Debris-avalanche megabreccia composed of displaced blocks of Yor and Tvy

Tst Tucson Wash Member—with reworked Cloudburst/Galiuro volcaniclast and net paleoflow (imbrication) to S55W (N=40)

Tsk Kanally Member—with mainly granitic (Oracle-Ruin) detritus and net paleoflow (from clast imbrication) to N60-65E (N=20)

Tvy Olivine-bearing basaltic andesite lava

Trf Rhyodacitic to rhyolitic felsite domes and plugs (Upper Oligocene to Lower Miocene)—Age is syn-Cloudburst, pre-San Manuel

Tcb Cloudburst Formation (Oligocene-Miocene)—Conglomeratic redbeds. Includes lower volcanic (~Galiuro Volcanics) and upper sedimentary members, as well as local map units

Tcs Sedimentary upper member—Alluvial fan to braidstream facies with volcanic and granitic clast; net paleoflow (imbrication) to N25E (N=20) but to N45W (N=5) south of Black Canyon fault; markerbeds: lb, lava/breccia; vs, volcanic sandstone; tu, silicic tuff (Tcs has redbed coloration)

Tch Hackberry Wash facies (Dickinson, 1991)—Located in the Tortilla Mountains southwest of the Gila River segment of the San Pedro trough where volcanic member (Tcv) is absent

Tcv Volcanic lower member—Mainly intermediate (andesite-latite) but also mafic and silicic (basalt, dacite) lava, flow-breccia, and varied volcaniclastic rocks

Tgv Galiuro Volcanics (Oligocene-Miocene)—Lateral equivalent of Cloudburst Formation

Tmi Mineta Formation (Oligocene)—Redbeds

Laramide (65-75 Ma) granitic plutons (small intrusive bodies not shown)

Kgp San Manuel granitic porphyry

Kgc Copper Creek granitic stock

Kgt Tortilla quartz diorite

Laramide (60-80 Ma) stratified units (lateral correlations uncertain)

Kaf American Flag Formation

Kcs Cascabel Formation

Kgv Glory Hole Volcanics

Kwv Williamson Canyon Volcanics

Kbi Bisbee Group (Lower Cretaceous)

Jwv Walnut Canyon Volcanics (Jurassic)

Pzs Sedimentary strata (Paleozoic)

Yap Apache Group (Middle Proterozoic) – Intruded locally by ~1100 Ma diabase sills and dikes not shown separately

Yat Apache Group and Troy Quartzite, undifferentiated—Intruded locally by ~ 1100 Ma diabase sills not shown separately

Yor Oracle-Ruin Granite (Middle Proterozoic, 1420-1450 Ma)—megacrystic

XYg Granodiorite (Precambrian)—Equigranular, probably a mafic phase of Oracle-Ruin Granite, but possibly related to older Madera Diorite (1625-1700 Ma)

Xjl Johnny Lyon Granodiorite (Lower Proterozoic, ~1625 Ma)

Xpi Pinal Schist (Lower Proterozoic, >1700 Ma)

Data Sources, Processing, and Accuracy

The original mylars of twelve 1:24,000-scale maps of the study area (Dickinson, 1993, 1998, 2000) were scanned by G. Stephen Pitts on a Scanographics CF500/4 scanner using ScanServ 3.5.1 software. Pitts mathematically generated a tic file with tics of the study area spaced at 2.5-minute intervals, and Karen Bolm rectified the scanned images using ESRI ArcView Image Analysis. Bolm and Tasha Lewis digitized the linework in ArcView (ver. 3.2) and attributed the lines and polygons. The digital files were then converted to ArcInfo (ver. 7.2) format, augumented with an interim geologic map data model (data base), further attributed and edited, and then plotted and compared to the original geologic maps to check for digitizing and attributing errors.

When the digital geologic maps were plotted and compared to the mylar originals (Dickinson, 1993, 1998, 2000), the authors discovered considerable north/south

distortion in the set of ten maps (Dickinson, 1998). A comparison of the mylars with their corresponding 1:24,000-scale base maps revealed a similar north/south distortion in the mylars. The authors concluded that the mylars probably stretched from being repeatedly run through a hot, roll-feed copy machine to make copies of the map for sale. Due to this distortion, it is difficult to estimate the accuracy of the Dickinson (1998) portion of the digital database. The horizontal accuracy of linear features is estimated to be within 24 meters. This digital database is not meant to be used at any scale larger than 1:24,000 (for example 1:12,000 or 1:2,000).

GIS Documentation

The digital geologic map of the Quiburis Formation and surrounding area includes a geologic linework arc attribute table, QUIB24K.AAT, that relates to the QUIB24K.CO3, QUIB24K.ST3, QUIB24K.LGU, and QUIB24K.REF files; a rock unit polygon attribute table, QUIB24K.PAT, that relates to the QUIB24K.RU and QUIB24K.REF files; and a geologic map symbol point attribute table, QUIB24KP.PAT, that relates to the QUIB24KP.SYM and QUIB24KP.REF files (see fig. 4). These data files are described below.

Linear Features

Descriptions of the items identifying linear features such as contacts, boundaries (for example, lines of latitude and longitude, state boundaries) and structures in the arc (or line) attribute table, QUIB24K.AAT, are as follows:

QUIB24K.AAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code used to identify type of linear feature. Linecodes < 100 are used for contacts and boundaries which are described in the QUIB24K.CO3 file. Linecodes > 100 and < 600 represent structural features which are described in the QUIB24K.ST3 file. Linecodes > 800 and < 900 represent linear geologic units which are described in QUIB24K.LGU
name	character	36	Name given to structural feature.
source	integer	4	Numeric code used to identify the data source for the linear feature. Complete references for the sources are listed in the QUIB24K.REF file.
desc	character	100	Written description of feature

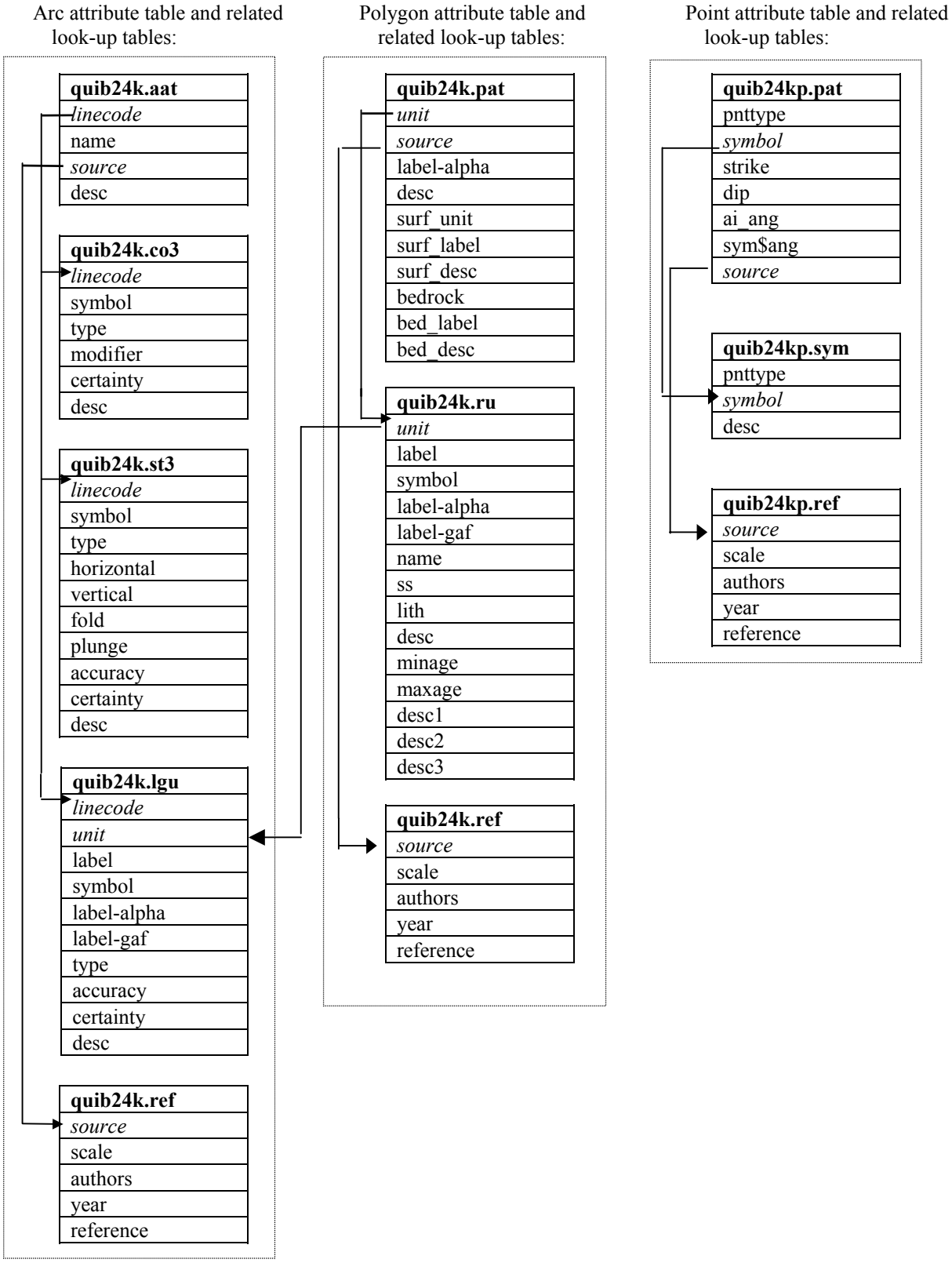

Figure 4: Relationships between feature attribute tables and look-up tables.

Attribute descriptions for items in the contact (and boundary) look-up table, QUIB24K.CO3 (for use with the GEOL_DIA.LIN lineset), are as follows:

QUIB24K.CO3			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value < 100) used to identify type of contact or boundary. (This item also occurs in QUIB24K.AAT.)
symbol	integer	3	Line symbol number used by Arc/Info to plot lines. Symbol numbers refer to the GEOL_DIA.LIN lineset.
type	character	10	Major type of line, for example, contact, state boundaries, lines of latitude and longitude used for neatlines.
modifier	character	20	Line type modifier, for example, approximate, concealed, gradational. No entry implies 'known.'
certainty	character	15	Degree of certainty of contact or boundary, for example, inferred, uncertain. No entry implies 'certain.'
desc	character	100	Written description or explanation of contact or boundary.

Attribute descriptions for items in the structure look-up table, QUIB24K.ST3 (for use with the GEOL_DIA.LIN lineset), are as follows:

QUIB24K.ST3			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value > 100 and < 600) used to identify type of structural feature. (This item also occurs in QUIB24K.AAT.)
symbol	integer	3	Line symbol number used by ArcInfo to plot arc (line). Symbol numbers refer to the GEOL_DIA.LIN lineset.
type	character	10	Major type of structure, for example, fault, fracture, fold, other.
horizontal	character	20	Type of horizontal fault movement, for example, left-lateral, right-lateral. No entry implies 'unknown.'
vertical	character	20	Type of vertical fault movement, for example, normal. No entry implies 'unknown.'
fold	character	15	Type of fold, for example, anticline, syncline.
plunge	character	15	Type of plunge on fold, for example, horizontal, plunging, plunging in, plunging out.
accuracy	character	15	Line type modifier indicating degree of accuracy, for example, approximately located, concealed, gradational. No entry implies 'known.'
certainty	character	15	Degree of certainty of contact or boundary, for example, inferred, uncertain. No entry implies 'certain.'
desc	character	100	Written description or explanation of structural feature.

Attribute descriptions for items in the linear geologic unit look-up table, QUIB24K.LGU (for use with the GEOL_DIA.LIN lineset), are as follows:

QUIB24K.LGU			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value > 800 and < 900) used to identify type of structural feature. (This item also occurs in QUIB24K.AAT.)
unit	integer	4	Numeric code used to identify the rock unit which is described in the QUIB24K.RU look-up table. (This item also occurs in QUIB24K.RU.)
label	character	10	Rock unit label (abbreviation) used to label unit on map. (This item is also located in the QUIB24K.RU look-up table.)
symbol	integer	3	Line symbol used by ArcInfo to plot arc (line). Symbol numbers refer to the GEOL_DIA.LIN lineset.
label-alpha	character	10	Rock unit label (abbreviation)
label-gaf	character	10	Rock unit label (abbreviation) that uses the GeoAgeFullAlpha font, ver. 1.1 (Richard Koch, personal commun., 2001)
type	character	10	Major type of line, for example, contact, state boundaries, lines of latitude and longitude used for neatlines
accuracy	character	15	Line type modifier indicating degree of accuracy, for example, approximately located, concealed, gradational. No entry implies 'known.'
certainty	character	15	Degree of certainty of contact or boundary, for example, inferred, uncertain. No entry implies 'certain.'
desc	character	100	Written description or explanation of linear geologic unit.

Areal Features

Descriptions of the items identifying geologic units in the polygon attribute table, QUIB24K.PAT, are as follows:

QUIB24K.PAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
unit	integer	4	Numeric code used to identify the rock unit which is described in the QUIB24K.RU look-up table. (This item also occurs in the QUIB24K.RU look-up table.)
source	integer	4	Numeric code used to identify the data source for the rock unit. Complete references for the sources are listed in the QUIB24KK.REF file.
label-alpha	character	10	Rock unit label (abbreviation) used to label *unit* on map using standard alpha characters. (This item was joined from the QUIB24K.RU look-up table.)
desc	character	250	Formal or informal unit name. (This item was joined from the QUIB24K.RU look-up table.)
surf_unit	integer	4	Numeric code used to identify the surficial rock that is described in the QUIB24K.RU look-up table under the item *unit*. (The item *surf_unit* does not occur in QUIB24K.RU.) The attribute values for *surf_unit* are a subset of the attribute values for *unit*. This item, *surf_unit*, is attributed only when the underlying bedrock has been identified.
surf_label	character	10	Surficial rock unit label (abbreviation).
surf_desc	character	250	Formal or informal surficial rock unit name. (This item was joined from the *desc* iten in QUIB24K.RU look-up table)
bedrock	integer	4	Numeric code used to identify the bedrock that is described in the QUIB24K.RU look-up table under the item *unit*. (The item *bedrock* does not occur in QUIG24K.RU.) The attribute values for *bedrock* are a subset of the attribute values for *unit*. This item, *bedrock*, is attributed only when the underlying bedrock has been identified.
bed_label	character	10	Bedrock unit label (abbreviation).
bed_desc	character	250	Formal or informal bedrock unit name. (This item was joined from the *desc* item in QUIB24K.RU look-up table.

Attribute descriptions for items in the lithology (rock unit) look-up table, QUIB24K.RU (for use with the WPGCMYK.SHD shadeset), are as follows:

QUIB24K.RU			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
unit	integer	4	Numeric code used to identify rock unit. (This item also occurs in QUIB24K.PAT.)
label	character	10	Rock unit label (abbreviation) used to label unit on map. This item was calculated equal to 'label-gaf'
symbol	integer	3	Shadeset symbol number used by ArcInfo to plot a filled/shaded polygon. The symbol numbers used in this file refer to the WPGCMYK.SHD shadeset.
label-alpha	character	10	Rock unit label (abbreviation)
label-gaf	character	10	Rock unit label (abbreviation) that uses the GeoAgeFullAlpha font, ver. 1.1 (Richard Koch, personal commun., 2001)
name	character	7	The prefix portion of the rock unit label that does not include subscripts. (If subscripting is not used in the original unit label, then the 'name' entry is the same as the 'label' entry.)
ss	character	3	The suffix portion of the geologic unit label that includes subscripts.
lith	character	20	Major type of lithostratigraphic unit, for example, unconsolidated sediments, sedimentary rocks, metasedimentary rocks, intrusive rocks, extrusive rocks, metamorphic rocks, water, ice.
desc	character	250	Formal or informal unit name
minage	character	7	Minimum stratigraphic age of lithologic unit, for example, CRET, TERT, M PROT.
maxage	character	7	Maximum stratigraphic age of lithologic unit
desc1	character	200	Detailed description of rock unit
desc2	character	200	Detailed description of rock unit (continued from desc1, if needed)
desc3	character	200	Detailed description of rock unit (continued from desc2, if needed)

Point Features

Descriptions of the items identifying geologic map symbols are given in the point attribute table, QUIB24KP.PAT, which is defined as follows:

QUIB24KP.PAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
pnttype	character	50	Basic type of geologic point data being represented (for example, inclined foliation, fault attitude, etc). (This item also occurs in the QUIB24KP.SYM file.)
symbol	integer	3	Marker symbol number used by ArcInfo to identify type of geologic map symbol. Symbol numbers refer to the SCAMP2D.MRK markerset (Matti and others, 1997). (This item also occurs in the QUIB24KP.SYM file.)
strike	integer	3	Strike of bedding, foliation or cleavage. Strike is an azimuthal angle (measured in degrees from 0 to 360 in a clockwise direction from North).
dip	integer	2	Dip of bedding, foliation or cleavage. This value is an angle measured (in degrees from 0 to 90) down from the horizontal; thus a horizontal dip is 0 degrees and a vertical dip is 90 degrees.
ai_ang	integer	4	An interim value used to calculate sym$angle. The various structural map symbols in the SCAMP2D.MRK markerset (Matti and others, 1997) had to be rotated by different amounts to achieve their proper map orientation. For the strike and dip symbols, ai_ang = strike – 270.
sym$ang	integer	3	The angle used to complete the mathematical rotation of the structural map symbol to its proper orientation on the map. The various point symbols in the SCAMP2D.MRK markerset (after Matti and others, 1997) had to be rotated by different amounts to achieve their proper map orientation. This value is the $angle pseudoitem value for the point.
source	integer	4	Numeric code used to identify the data source for the structural map symbol. Complete references for the sources are listed in the QUIB24KP.REF file.

Attribute descriptions for items in the geologic map symbols look-up table, QUIB24KP.SYM, [for use with the SCAMP2D.MRK markerset (Matti and others, 1997)], are as follows:

QUIB24KP.SYM			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
pnttype	character	50	Type of point symbol, for example, strike and dip of inclined bedding, strike and dip of inclined cleavage. (This item also occurs in the QUIB24KP.PAT file.)
symbol	integer	3	Marker symbol number used by ArcInfo to identify type of structural map symbol. Symbol numbers refer to the SCAMP2D.MRK markerset (Matti and others, 1997).
desc	character	250	Written description or explanation of map symbol.

Source Attributes

Descriptive source or reference information for the QUIB24K and QUIB24KP ArcInfo datasets is stored in the QUIB24K.REF and QUIB24KP.REF files, respectively. Attribute descriptions for items in the QUIB24K.REF and QUIB24KP.REF data source files are as follows:

QUIB24K.REF / QUIB24KP.REF			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
source	integer	4	Numeric code used to identify the data source. (This item also occurs in the QUIB24K.AAT, QUIB24K.PAT, and QUIB24KP.PAT files.)
scale	integer	8	Scale of source map. (This value is the denominator of the proportional fraction that identifies the scale of the map that was digitized or scanned to produce the digital map.)
authors	character	200	Author(s) or compiler(s) of source map entered as last name, first name or initial, and middle initial.
year	integer	4	Source (map) publication date
reference	character	250	Remainder of reference in USGS reference format.

Obtaining Digital Data

The complete digital version of the geologic map is available in ArcInfo interchange format with associated data files. These data are maintained in a Universal Transverse Mercator (UTM) map projection (QUIB24K):

Projection:	UTM
Zone:	12
Units:	meters
Datum:	NAD27

and in a geographic reference system (latitude and longitude) (QUIB24KG):

Projection:	geographic
Units:	decimal degrees
Datum:	NAD27

To obtain copies of the digital data, do one of the following:

- Download the digital files from the USGS public access World Wide Web site on the Internet: URL = http://geopubs.wr.usgs.gov/open-file/of02-393/ OR
- Anonymous FTP from geopubs.wr.usgs.gov, in the directory pub/open-file/of02-393/

These Internet sites contain the spatial digital database and metadata for the geologic map of the Quiburis Formation and surrounding units as ArcInfo exchange-format files (see listing of files in Appendix A). Formatted metadata (Federal Geographic Data Committee-compliant) is included as Appendix B.

To manipulate these data in a geographic information system (GIS), you must have a GIS that is capable of reading ArcInfo interchange-format files.

Obtaining Paper Maps

Paper copies of the digital geologic map are not available from the U.S Geological Survey. However, with access to the Internet and access to large-format color plotter that can interpret PDF (portable document format) files, 1:125,000-scale paper copies can be made. The database includes the entire area of the twelve 1:24,000-scale map sheets in the original publications (Dickinson 1993, 1998, 2000); however, a single plot at 1:24,000 would be too large for a plotter. Hence a single plot at 1:125,000 (quib24k_map.pdf) has been made which approximates the extent of the original map sheets.

1. Download the digital version of the map sheet, quib24k_map.pdf from the USGS public access World Wide Web site on the Internet using the URL = http://geopubs.wr.usgs.gov/open-file/of02-393/
or
2. Anonymous FTP the plot files listed above from geopubs.wr.usgs.gov, in the directory pub/open-file/of02-393/

The sheet is formatted to fit on a 36-inch by-48 inch sheet.
Paper copies of the map can also be created by obtaining the digital files described in the previous section and then creating a plot file in a GIS.

References Cited

Dickinson, W.R., 1991, Tectonic setting of faulted Tertiary strata associated with the Catalina cone complex in southern Arizona: Geological Society of America Special Paper 264, 106 p.

Dickinson, W.R., 1993, Summary geologic map of Black Hills near Mammoth, Pinal County, Arizona: Tucson, Arizona Geological Survey Contributed Map CM-93-B, scale 1:24,000.

Dickinson, W.R., 1998, Facies map of post-mid-Miocene Quiburis Formation, San Pedro trough, Pinal, Pima, Gila, Graham, and Cochise counties, Arizona: Tucson, Arizona Geological Survey Contributed Map CM-98-A, 10 sheets, scale 1:24,000, 6 p. text.

Dickinson, W.R., 2000, Summary of Tertiary stratigraphic and structural relationships, Camp Grant Wash—Antelope Peak area, Pinal County, Arizona: Tucson, Arizona Geological Survey Contributed Map CM-00-B, scale 1:24,000, 10 p. text.

Matti, J.C., Miller, F.K., Powell, R.E., Kennedy, S.A., Bunyapanasarn, T.P., Koukladas, C., Hauser, R.M., and Cossette, P.M., 1997, Geologic-point attributes for digital geologic-map data bases produced by the Southern California Areal Mapping Project (SCAMP): U.S. Geological Survey Open-File Report 97-859, 7 p.

Appendix A – List of files in the Quiburis GIS

--Uncompress the quib24k.tar.Z file and extract the files from the resultant quib24k.tar file.
--Use the 'importfile.aml' to IMPORT all of the *.E00 files for use in ArcInfo.

Primary ArcInfo exchange-format (*.e00) and metadata (*.met) files for the spatial digital databases:

- quib24k.e00 – line and poly GIS (contacts, faults, folds, and map units) in UTM projection
- quib24kg.e00 – line and poly GIS (contacts, faults, folds, and map units) in a geographic reference system (latitude and longitude)

- quib24kp.e00 – point GIS (structural data such as strike and dips, and fault attitudes) in UTM projection
- quib24kpg.e00 – point GIS (structural data such as strike and dips, and fault attitudes) in a geographic reference system (latitude and longitude)

- quib24k.met – metadata

Files in this package have been attributed to produce plots using the shade, line, and marker sets listed below. These sets are included for the user's convenience.

- fnt026.e00 – font
- fnt037.e00 – font
- geoafa_.fon – font file
- geoafa _.pfb –font file
- geol_dia.lin.e00 – lineset
- wpgcmyk.shd.e00 – shadeset
- scamp2d.mrk.e00 – markerset

Special geographic characters used in unit designations are from the Geoage font group and may be obtained at the following web site:

Server:	onyx.wr.usgs.gov
UserID:	anonymous
Password:	your e-mail address
Directory:	pub/wpg/supplies/geoage_1.1 and pub/wpg/supplies/geoage_1.2

The following portable document format (.pdf) files are included in the data set:

- of02-393.pdf — report text
- quib24k_map.pdf — digital map sheet (plotted at 1:125,000) Not all point data are included on the map because of the density of the points and the reduced scale of the map.

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Appendix B – Metadata file (quib24k.met) for the Quiburis GIS

```
Identification_Information:
  Citation:
    Citation_Information:
      Originator: Karen S. Bolm
      Originator: Tasha Lewis
      Originator: Douglas M. Hirschberg
      Originator: G. Stephen Pitts
      Originator: William R. Dickinson
      Publication_Date: 20020930
      Title:
        Spatial Digital Database for the Geology of the San Pedro
        River Basin in Cochise, Gila, Graham, Pima, and Pinal
        Counties, Arizona
      Edition: Version 1
      Geospatial_Data_Presentation_Form: map
      Series_Information:
        Series_Name: U.S. Geological Survey Open-File Report
        Issue_Identification: 02-393
      Publication_Information:
        Publication_Place: Menlo Park, CA
        Publisher: U.S. Geological Survey
      Online_Linkage:
         <URL:http://geopubs.wr.usgs.gov/open-file/of02-393>
  Description:
    Abstract:
      This open-file report is a digital representation of the
      Dickinson (1993, 1998, 2000) remapping of the post-Mid-
      Miocene Quiburis Formation in southeastern Arizona.  It
      delineates constituent facies of the Formation throughout
      the San Pedro trough.
    Purpose:
      This dataset was developed to provide geologic map GIS of the
      Quiburis Formation for use in future spatial analysis by a
      variety of users.  These data can be printed in a variety of
      ways to display various geologic features or used for digital
      analysis and modeling.  It was digitized from 1:24,000-scale
      maps.  The digital database is not meant to be used or
      displayed at any scale larger than 1:24,000 (for example,
      1:12,000).
  Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: 2002
    Currentness_Reference: publication date
  Status:
    Progress: Complete
    Maintenance_and_Update_Frequency: None Planned
  Spatial_Domain:
    Bounding_Coordinates:
      West_Bounding_Coordinate: -110.99145886
      East_Bounding_Coordinate: -110.23607166
      North_Bounding_Coordinate: 33.1602919
      South_Bounding_Coordinate: 32.15710412
  Keywords:
    Theme:
      Theme_Keyword_Thesaurus: none
```

```
    Theme_Keyword: geology
    Theme_Keyword: digital geologic map
  Place:
    Place_Keyword_Thesaurus: none
    Place_Keyword: United States
    Place_Keyword: Arizona
    Place_Keyword: San Pedro trough
    Place_Keyword: Pinal County
    Place_Keyword: Pima County
    Place_Keyword: Gila County
    Place_Keyword: Graham County
    Place_Keyword: Cochise County
    Place_Keyword: Camp Grant Wash
    Place_Keyword: Antelope Peak
    Place_Keyword: Black Hills
    Place_Keyword: San Pedro River
    Place_Keyword: Black Mountain Quadrangle
    Place_Keyword: Brandenburg Mountain Quadrangle
    Place_Keyword: Buehman Canyon Quadrangle
    Place_Keyword: Campo Bonito Quadrangle
    Place_Keyword: Cherry Spring Peak Quadrangle
    Place_Keyword: Clark Ranch Quadrangle
    Place_Keyword: Dudleyville Quadrangle
    Place_Keyword: Hayden Quadrangle
    Place_Keyword: Holy Joe Peak Quadrangle
    Place_Keyword: Hot Tamale Peak Quadrangle
    Place_Keyword: Happy Valley Quadrangle
    Place_Keyword: Kielberg Canyon Quadrangle
    Place_Keyword: Kearny Quadrangle
    Place_Keyword: Lookout Mountain Quadrangle
    Place_Keyword: Mammoth Quadrangle
    Place_Keyword: Mount Bigelow Quadrangle
    Place_Keyword: North of Oracle Quadrangle
    Place_Keyword: Oracle Quadrangle
    Place_Keyword: Peppersauce Wash Quadrangle
    Place_Keyword: Piety Hill Quadrangle
    Place_Keyword: Putnam Wash Quadrangle
    Place_Keyword: Redington Quadrangle
    Place_Keyword: Rhodes Peak Quadrangle
    Place_Keyword: Soza Canyon Quadrangle
    Place_Keyword: Soza Mesa Quadrangle
    Place_Keyword: Winkelman Quadrangle
    Place_Keyword: Wildhorse Mountain Quadrangle
Access_Constraints: none
Use_Constraints:
  This digital database is not meant to be used or displayed at
  any scale larger than 1:24,000 (for example, 1:12,000).

  Any hardcopies utilizing this dataset shall clearly indicate
  their source.  If the user has modified the data in any way,
  he is obligated to describe the types of modifications he has
  performed on the hardcopy map.  User specifically agrees not to
  misrepresent this dataset nor to imply that changes he made were
  approved by the U.S. Geological Survey.
Point_of_Contact:
  Contact_Information:
    Contact_Person_Primary:
      Contact_Person: Karen S. Bolm
      Contact_Organization: U.S. Geological Survey
    Contact_Position: Physical Scientist
```

```
      Contact_Address:
        Address_Type: mailing and physical address
        Address: 520 North Park Avenue #355
        City: Tucson
        State_or_Province: AZ
        Postal_Code: 85719
        Country: USA
      Contact_Voice_Telephone: (520) 670-5544
      Contact_Facsimile_Telephone: (520) 670-5113
      Contact_Electronic_Mail_Address: kbolm@usgs.gov
  Data_Set_Credit:
    Karen S. Bolm and Tasha Lewis digitized these data from scans of
    the Dickinson (1993, 1998, 2000) maps made by G. Stephen Pitts.
    Douglas M. Hirschberg provided programs to aid in attribution
    of the data, and William R. Dickinson provided attribute
    information, assisted in the editing, and resolved problems
    resulting from the combination of three maps.

  Native_Data_Set_Environment:
    SunOS, 5.6, sun4u UNIX
    ARCINFO version 7.2.1
    ARCINFO version 8.1
    ArcView version 3.2 for Windows
Data_Quality_Information:
  Attribute_Accuracy:
    Attribute_Accuracy_Report:
      When the digitized maps were printed and compared to the
      Dickinson (1998) mylar originals, a considerable north/south
      distortion was discovered. The mylar originals were compared
      to topographic maps of the same area and it was determined
      that the distortion was due to the mylars becoming stretched
      during repetitive copy processing.  Because of this distortion
      of the Dickinson(1998) maps, it is difficult to estimate
      the accuracy of this digital map.

      Accuracy of the digitized versions of the Dickinson (1993, 2000)
      maps was verified by manual comparison of the source with hard
      copy printouts and plots and with screen images.

  Logical_Consistency_Report:
    Polygon and chain-node topology present.

    The Dickinson (1993, 1998, 2000) maps were digitized by Karen S.
    Bolm and Tasha Lewis.  Attributes have the same meaning throughout
    the maps.  In some cases, however, units and lines symbols were
    not consistent from one map to the other.  In those cases, one
    attribute had to be chosen over the other.
  Completeness_Report:
    Some of the units at the edge of the Dickinson (1993, 1998,
    2000) maps were labeled, but accurate contacts were not
    defined.  In those cases, either units were attributed as
    "unmapped" or not included on the digital version or new
    contacts were added by William R. Dickinson.  Some labeling,
    which could not be easily included as attribution, was omitted.
    Also, some of the symbolization chosen for this dataset is
    different than that used by Dickinson (1993, 1998, 2000).  This
    was done to standardize products.

    The original Dickinson (1993, 1998, 2000) maps were drawn on
    topographic background.  Digital versions of those topographic
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  maps are not included with this dataset.

Positional_Accuracy:
  Horizontal_Positional_Accuracy:
    Horizontal_Positional_Accuracy_Report:
      Due to distortions in the original maps, it was impossible to
      test the accuracy of the digital mapping of the Dickinson (1998)
      maps.  Based on testing of the the Dickinson (1993, 2000) maps,
      it is estimated that the features are accurate to within
      24 meters.

Lineage:
  Source_Information:
    Source_Citation:
      Citation_Information:
        Originator: William R. Dickinson
        Publication_Date: 1993
        Title:
          Summary Geologic Map of the Black Hills near Mammoth; Pinal
          County, Arizona
        Geospatial_Data_Presentation_Form: map
        Series_Information:
          Series_Name: Arizona Geological Survey Contributed Map
          Issue_Identification: CM-93-B
        Publication_Information:
          Publication_Place: Tucson, AZ
          Publisher: Arizona Geological Survey
    Source_Scale_Denominator: 24000
    Type_of_Source_Media: mylar
    Source_Time_Period_of_Content:
      Time_Period_Information:
        Single_Date/Time:
          Calendar_Date: 1993
      Source_Currentness_Reference: publication date
    Source_Citation_Abbreviation: Dickinson (1993)
    Source_Contribution:
      Dickinson (1993) was one of the three sources of geologic
      information uesd to compile the QUIB24K database.
  Source_Information:
    Source_Citation:
      Citation_Information:
        Originator: William R. Dickinson
        Publication_Date: 1998
        Title:
          Facies Map of Post-Mid-Miocene Quiburis Formation, San Pedro
          Trough, Pinal, Pima, Gila, Graham, and Cochise Counties,
          Arizona
        Geospatial_Data_Presentation_Form: map
        Series_Information:
          Series_Name: Arizona Geological Survey Contributed Map
          Issue_Identification: CM-98-A
        Publication_Information:
          Publication_Place: Tucson, AZ
          Publisher: Arizona Geological Survey
    Source_Scale_Denominator: 24000
    Type_of_Source_Media: mylar
    Source_Time_Period_of_Content:
      Time_Period_Information:
        Single_Date/Time:
          Calendar_Date: 1998
```

```
    Source_Currentness_Reference: publication date
  Source_Citation_Abbreviation: Dickinson (1998)
  Source_Contribution:
    Dickinson (1998) was one of the three sources of geologic
    information used to compile the QUIB24K database.
Source_Information:
  Source_Citation:
    Citation_Information:
      Originator: William R. Dickinson
      Publication_Date: 2000
      Title:
        Summary of Tertiary Stratigraphic and Structural
        Relationships, Camp Grant-Antelope Peak Area, Pinal
        County, Arizona
      Geospatial_Data_Presentation_Form: map
      Series_Information:
        Series_Name: Arizona Geological Survey Contributed Map
        Issue_Identification: CM-00-B
      Publication_Information:
        Publication_Place: Tucson, AZ
        Publisher: Arizona Geological Survey
  Source_Scale_Denominator: 24000
  Type_of_Source_Media: mylar
  Source_Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: 2000
    Source_Currentness_Reference: publication date
  Source_Citation_Abbreviation: Dickinson (2000)
  Source_Contribution:
    Dickinson (2000) was one of the three sources of geologic
    information uesd to compile the QUIB24K database.
Process_Step:
  Process_Description:
    Twelve 1:24,000-scale mylar maps that comprise three Dickinson
    (1993, 1998, 2000) reports were scanned by G. Stephen Pitts
    on a Scanographics CF500/4 scanner using ScanServ 3.5.1
    software.
    Pitts mathmetically generated a tic file with tics of the study
    area spaced at 2.5' intervals, and Karen S. Bolm rectified the
    scanned images using ESRI ArcView Image Analysis.  Bolm and
    Tasha Lewis digitized the linework using Geologic Mapping Tools,
    An ArcView extension developed by William R. Kelley (contractor
    At the U.S. Geological Survey's Western Regional Mineral
    Resources Team, Spokane Field Office).  Lines and polygons were
    Attributed by Bolm in ArcInfo 7.2.1.

    Points were digitized from the scanned images using digpnt.aml,
    and attribution was retrieved for annotation using getdip.aml,
    both programs written by Douglas M. Hirschberg.
  Process_Date: 2000-2001
Process_Step:
  Process_Description:
    After review, it was decided to merge the three Dickinson (1993,
    1998, 2000) maps into a single spatial digital database.  The
    coverages were merged by Karen S. Bolm, and discrepancies were
    resolved by her and William R. Dickinson.  Some additional
    contacts had to be added to separate units that were originally
    on the edges of the mapped areas.  Duplicate lines and points
    were removed.  Maps were plotted at 1:24,000 and checked for
```

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        errors.
      Process_Date: 2002
Spatial_Data_Organization_Information:
  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information:
    SDTS_Terms_Description:
      SDTS_Point_and_Vector_Object_Type: Point
      Point_and_Vector_Object_Count: 430
      SDTS_Point_and_Vector_Object_Type: String
      Point_and_Vector_Object_Count: 2253
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 431
Spatial_Reference_Information:
  Horizontal_Coordinate_System_Definition:
    Planar:
      Grid_Coordinate_System:
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 12
          Transverse_Mercator:
            Scale_Factor_at_Central_Meridian: 1.000000
            Longitude_of_Central_Meridian: -111.000000
            Latitude_of_Projection_Origin: 0.000000
            False_Easting: 0.000000
            False_Northing: 0.000000
      Planar_Coordinate_Information:
        Planar_Coordinate_Encoding_Method: coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution: 0.1090807765722
          Ordinate_Resolution: 0.1090807765722
        Planar_Distance_Units: Meters
    Geodetic_Model:
      Horizontal_Datum_Name: North American Datum of 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98
Entity_and_Attribute_Information:
  Detailed_Description:
    Entity_Type:
      Entity_Type_Label: quib24k.aat
      Entity_Type_Definition: Geologic units, their labels and
descriptions
    Attribute:
      Attribute_Label: linecode
      Attribute_Definition:
        Numeric code used to identify type of linear feature.
        Linecodes < 100 are used for contacts and boundaries
        which are described in the QUIB24K.CO3 file.Linecodes >
        100 and < 600 represent structural features which are
        described in the QUIB24K.ST3 file.Linecodes > 800 and <
        900 represent linear geologic units which are described
        in QUIB24K.LGU
    Attribute:
      Attribute_Label: name
      Attribute_Definition: Name given to structural feature
    Attribute:
      Attribute_Label: source
      Attribute_Definition:
        Numeric code used to identify the data source for the
        linear feature.  Complete references for the sources are
```

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        listed in the QUIB24K.REF file.
    Attribute:
      Attribute_Label: desc
      Attribute_Definition: Written description of feature
    Entity_Type:
      Entity_Type_Label: quib24k.co3
      Entity_Type_Definition:
        Attribute description for items in the contact
        (and boundary) look-up table
    Attribute:
      Attribute_Label: linecode
      Attribute_Definition:
        Numeric code (a value < 100) used to identify type of
        contact or boundary.  (This item also occurs in
        QUIB24K.AAT.)
    Attribute:
      Attribute_Label: symbol
      Attribute_Definition:
        Line symbol number used by Arc/Info to plot lines. Symbol
        numbers refer to the GEOL_DIA.LIN lineset.
      descriptions for items in the contact (and boundary) look-table
    Attribute:
      Attribute_Label: type
      Attribute_Definition:
        Major type of line, for example, contact, state boundaries,
        lines of latitude and longitude used for neatlines.
      descriptions for items in the contact (and boundary) look-table
    Attribute:
      Attribute_Label: modifier
      Attribute_Definition:
        Line type modifier, for example, approximate, concealed,
        gradational.  No entry implies "known."
      descriptions for items in the contact (and boundary) look-table
    Attribute:
      Attribute_Label: certainty
      Attribute_Definition:
        Degree of certainty of contact or boundary, for example,
        inferred, uncertain.  No entry implies "certain."
    Attribute:
      Attribute_Label: desc
      Attribute_Definition_Source: Written description or explanation of
contact or boundary.
    Entity_Type:
      Entity_Type_Label: quib24k.st3
      Entity_Type_Definition:
        Attribute description for items in the structure look-up
        table
    Attribute:
      Attribute_Label: linecode
      Attribute_Definition:
        Numeric code (a value > 100 and < 600) used to identify
        type of structural feature.  (This item also occurs in
        QUIB24K.AAT.)
    Attribute:
      Attribute_Label: symbol
      Attribute_Definition:
        Line symbol number used by ArcInfo to plot arc (line).
        Symbol numbers refer to the GEOL_DIA.LIN lineset.
    Attribute:
      Attribute_Label: type
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      Attribute_Definition: Major type of structure, for example, fault,
fracture, fold, other.
    Attribute:
      Attribute_Label: horizontal
      Attribute_Definition:
        Type of horizontal fault movement, for example, left-
        lateral, right-lateral.  No entry implies "unknown."
    Attribute:
      Attribute_Label: vertical
      Attribute_Definition:
        Type of vertical fault movement, for example, normal.
        No entry implies "unknown."
    Attribute:
      Attribute_Label: fold
      Attribute_Definition: Type of fold, for example, anticline,
syncline.
    Attribute:
      Attribute_Label: plunge
      Attribute_Definition:
        Type of plunge on fold, for example, horizontal, plunging,
        plunging in, plunging out.
    Attribute:
      Attribute_Label: accuracy
      Attribute_Definition:
        Line type modifier indicating degree of accuracy, for
        example, approximately located, concealed, gradational.
        No entry implies "known."
    Attribute:
      Attribute_Label: certainty
      Attribute_Definition:
        Degree of certainty of contact or boundary, for example,
        inferred, uncertain.  No entry implies "certain."
    Attribute:
      Attribute_Label: desc
      Attribute_Definition: Written description or explanation of
structural feature.
    Entity_Type:
      Entity_Type_Label: quib24k.lgu
      Entity_Type_Definition:
        Attribute descriptions for items in the linear geologic
        unit look-up table
    Attribute:
      Attribute_Label: linecode
      Attribute_Definition:
        Numeric code (a value > 800 and < 900) used to identify
        type of structural feature.  (This item also occurs in
        QUIB24K.AAT.)
    Attribute:
      Attribute_Label: unit
      Attribute_Definition:
        Numeric code used to identify the rock unit which is
        described in the QUIB24K.RU look-up table.  (This item
        also occurs in QUIB24K.RU.)
    Attribute:
      Attribute_Label: label
      Attribute_Definition:
        Rock unit label (abbreviation) used to label unit on map.
        (This item is also located in the QUIB24K.RU look-up
        table.)
    Attribute:
```

```
  Attribute_Label: symbol
  Attribute_Definition:
    Line symbol used by ArcInfo to plot arc (line).  Symbol
    numbers refer to the GEOL_DIA.LIN lineset.
Attribute:
  Attribute_Label: label-alpha
  Attribute_Definition: Rock unit label (abbreviation)
Attribute:
  Attribute_Label: label-gaf
  Attribute_Definition:
    Rock unit label (abbreviation) that uses the GeoAgeFullAlpha
    font, ver. 1.1 (Richard Koch, personal commun., 2001)
Attribute:
  Attribute_Label: type
  Attribute_Definition:
    Major type of line, for example, contact, state
    boundaries, lines of latitude and longitude used for
    neatlines
Attribute:
  Attribute_Label: accuracy
  Attribute_Definition:
    Line type modifier indicating degree of accuracy, for
    example, approximately located, concealed, gradational.
    No entry implies "known."
Attribute:
  Attribute_Label: certainty
  Attribute_Definition:
    Degree of certainty of contact or boundary, for example,
    inferred, uncertain.  No entry implies "certain."
Attribute:
  Attribute_Label: desc
  Attribute_Definition:
    Written description or explanation of linear geologic
    unit.
Entity_Type:
  Entity_Type_Label: quib24k.pat
  Entity_Type_Definition:
    Descriptions of the items identifying geologic units in
    the polygon attribute table
Attribute:
  Attribute_Label: unit
  Attribute_Definition:
    Numeric code used to identify the rock unit which is
    described in the QUIB24K.RU look-up table.  (This item
    also occurs in the QUIB24K.RU look-up table.)
Attribute:
  Attribute_Label: source
  Attribute_Definition:
    Numeric code used to identify the data source for the
    rock unit.  Complete references for the sources are
    listed in the QUIB24KK.REF file.
Attribute:
  Attribute_Label: label-alpha
  Attribute_Definition:
    Rock unit label (abbreviation) used to label unit on map
    using standard alpha characters.  (This item was joined
    from the QUIB24K.RU look-up table.)
Attribute:
  Attribute_Label: desc
  Attribute_Definition:
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    Formal or informal unit name.  (This item was joined from
    the QUIB24K.RU look-up table.)
Attribute:
  Attribute_Label: surf_unit
  Attribute_Definition:
    Numeric code used to identify the surficial rock that is
    described in the QUIB24K.RU look-up table under the item
    unit.  (The item surf_unit does not occur in QUIB24K.RU.)
    The attribute values for surf_unit are a subset of the
    attribute values for unit.  This item, surf_unit, is
    attributed only when the underlying bedrock has been
    identified.
Attribute:
  Attribute_Label: surf_label
  Attribute_Definition: Surficial rock unit label (abbreviation).
Attribute:
  Attribute_Label: surf_desc
  Attribute_Definition:
    Formal or informal surficial rock unit name.
    (This item was joined from the desc iten in QUIB24K.RU
    look-up table)
Attribute:
  Attribute_Label: bedrock
  Attribute_Definition:
    Numeric code used to identify the bedrock that is
    described in the QUIB24K.RU look-up table under the item
    unit. (The item bedrock does not occur in QUIG24K.RU.)
    The attribute values for bedrock are a subset of the
    attribute values for unit.  This item, bedrock, is
    attributed only when the underlying bedrock has been
    identified.
Attribute:
  Attribute_Label: bed_label
  Attribute_Definition: Bedrock unit label (abbreviation).
Attribute:
  Attribute_Label: bed_desc
  Attribute_Definition:
    Formal or informal bedrock unit name.
    (This item was joined from the desc item in QUIB24K.RU
    look-up table.
Entity_Type:
  Entity_Type_Label: quib24k.ru
  Entity_Type_Definition:
    Attribute descriptions for items in the lithology (rock unit)
    look-up table
Attribute:
  Attribute_Label: unit
  Attribute_Definition:
    Numeric code used to identify rock unit. (This item also
    occurs in QUIB24K.PAT.)
Attribute:
  Attribute_Label: label
  Attribute_Definition:
    Rock unit label (abbreviation) used to label unit on map.
    This item was calculated equal to "label-gaf"
  descriptions for items in the lithology (rock unit) look-up table
Attribute:
  Attribute_Label: symbol
  Attribute_Definition:
    Shadeset symbol number used by ArcInfo to plot a filled/
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    shaded polygon.  The symbol numbers used in this file
    refer to the WPGCMYK.SHD shadeset.
Attribute:
  Attribute_Label: label-alpha
  Attribute_Definition: Rock unit label (abbreviation)
Attribute:
  Attribute_Label: label-gaf
  Attribute_Definition:
    Rock unit label (abbreviation) that uses the GeoAgeFullAlpha
    font, ver. 1.1 (Richard Koch, personal commun., 2001)
Attribute:
  Attribute_Label: name
  Attribute_Definition:
    The prefix portion of the rock unit label that does not
    include subscripts.  (If subscripting is not used in the
    original unit label, then the "name" entry is the same as
    the "label" entry.)
Attribute:
  Attribute_Label: ss
  Attribute_Definition:
    The suffix portion of the geologic unit label that
    includes subscripts.
Attribute:
  Attribute_Label: lith
  Attribute_Definition:
    Major type of lithostratigraphic unit, for example,
    unconsolidated sediments, sedimentary rocks,
    metasedimentary rocks, intrusive rocks, extrusive rocks,
    metamorphic rocks, water, ice.
Attribute:
  Attribute_Label: desc
  Attribute_Definition: Formal or informal unit name
Attribute:
  Attribute_Label: minage
  Attribute_Definition:
    Minimum stratigraphic age of lithologic unit, for example,
    CRET, TERT, M PROT.
Attribute:
  Attribute_Label: maxage
  Attribute_Definition: Maximum stratigraphic age of lithologic unit
Attribute:
  Attribute_Label:
  Attribute_Definition: Detailed description of rock unit
Attribute:
  Attribute_Label: desc2
  Attribute_Definition:
    Detailed description of rock unit (continued from desc1,
    if needed)
Attribute:
  Attribute_Label: desc3
  Attribute_Definition:
    Detailed description of rock unit (continued from desc2,
    if needed)
Entity_Type:
  Entity_Type_Label: quib24kp.pat
  Entity_Type_Definition:
    Descriptions of the items identifying geologic map
    symbols are given in the point attribute table
Attribute:
  Attribute_Label: pnttype
```

```
  Attribute_Definition:
    Basic type of geologic point data being represented
    (for example, inclined foliation, fault attitude, etc).
    (This item also occurs in the QUIB24KP.SYM file.)
Attribute:
  Attribute_Label: symbol
  Attribute_Definition:
    Marker symbol number used by ArcInfo to identify type of
    geologic map symbol.  Symbol numbers refer to the
    SCAMP2D.MRK markerset (Matti and others, 1997).
    (This item also occurs in the QUIB24KP.SYM file.)
Attribute:
  Attribute_Label: strike
  Attribute_Definition:
    Strike of bedding, foliation or cleavage.  Strike is an
    azimuthal angle (measured in degrees from 0 to 360 in a
    clockwise direction from North).
Attribute:
  Attribute_Label: dip
  Attribute_Definition:
    Dip of bedding, foliation or cleavage.  This value is an
    angle measured (in degrees from 0 to 90) down from the
    horizontal; thus a horizontal dip is 0 degrees and a
    vertical dip is 90 degrees.
Attribute:
  Attribute_Label: ai_ang
  Attribute_Definition:
    An interim value used to calculate sym$angle.  The various
    structural map symbols in the SCAMP2D.MRK markerset
    (Matti and others, 1997) had to be rotated by different
    amounts to achieve their proper map orientation.  For the
    strike and dip symbols, ai_ang = strike -270.
Attribute:
  Attribute_Label: sym$ang
  Attribute_Definition:
    The angle used to complete the mathematical rotation of
    the structural map symbol to its proper orientation on
    the map.  The various point symbols in the SCAMP2D.MRK
    markerset (after Matti and others, 1997) had to be
    rotated by different amounts to achieve their proper map
    orientation.  This value is the $angle pseudoitem value
    for the point.
Attribute:
  Attribute_Label: source
  Attribute_Definition:
    Numeric code used to identify the data source for the
    structural map symbol.  Complete references for the
    sources are listed in the QUIB24KP.REF file.
Entity_Type:
  Entity_Type_Label: quib24kp.sym
  Entity_Type_Definition:
    Attribute descriptions for items in the geologic map
    symbols look-up table
Attribute:
  Attribute_Label: pnttype
  Attribute_Definition:
    Type of point symbol, for example, strike and dip of
    inclined bedding, strike and dip of inclined cleavage.
    This item also occurs in the QUIB24KP.PAT file.)
Attribute:
```

```
      Attribute_Label: symbol
      Attribute_Definition:
        Marker symbol number used by ArcInfo to identify type of
        structural map symbol.  Symbol numbers refer to the
        SCAMP2D.MRK markerset (Matti and others, 1997).
      descriptions for items in the geologic map symbols look-up table
    Attribute:
      Attribute_Label: desc
      Attribute_Definition:
        Written description or explanation of map symbol.
    Entity_Type:
      Entity_Type_Label: quib24k.ref and quib24kp.ref
      Entity_Type_Definition:
        Descriptive source or reference information for the
        quib24k and quib 24kp ArcInfo datasets
    Attribute:
      Attribute_Label: source
      Attribute_Definition:
        Numeric code used to identify the data source.
        (This item also occurs in the QUIB24K.AAT, QUIB24K.PAT,
        and QUIB24KP.PAT files.)
    Attribute:
      Attribute_Label: scale
      Attribute_Definition:
        Scale of source map.  (This value is the denominator of
        the proportional fraction that identifies the scale of
        the map that was digitized or scanned to produce the
        digital map.)
    Attribute:
      Attribute_Label: authors
      Attribute_Definition:
        Author(s) or compiler(s) of source map entered as last
        name, first name or initial, and middle initial.
    Attribute:
      Attribute_Label: year
      Attribute_Definition: Source (map) publication date
    Attribute:
      Attribute_Label: reference
      Attribute_Definition:
        Remainder of reference in USGS reference format.
  Overview_Description:
    Entity_and_Attribute_Overview:
      The "Spatial Digital Database for the Geology of the San Pedro
      River Basin in Cochise, Gila, Graham, Pima, and Pinal Counties,
      Arizona" report (quib24k.pdf) contains a detailed description
      of each attribute code and a reference to the associated
      map symbols in the map source materials.  The database includes a
      geologic linework arc attribute table, quib24k.aat, that relates
      to the quib24k.co3 (contact look-up table), quib24k.st2
      (structure look-up table), quib24k.lgu (linear geologic
      units look-up table), and quib24k.ref (source reference
      look-up table) files and a rock unit polygon attribute
      table, quib24k.pat, that relates to the quib24k.ru (rock
      unit look-up table) and quib24k.ref (source reference look-up
      table) files.  Associated with this database is a geologic
      marker point attribute table, quib24kp.pat that relates to
      quib24kp.sym (symbol description look-up table) and
      quib24kp.ref (source reference look-up table).

    Entity_and_Attribute_Detail_Citation:
```

```
      See the of02-393.pdf file (available at http://geopubs.wr.usgs.
      gov/open-file/of02-393) for detailed description of items in
      this database.

Distribution_Information:
  Distributor:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: U.S. Geological Survey
      Contact_Address:
        Address_Type: electronic
        Address: http://geopubs.wr.usgs.gov/open-file/of02-393
      Contact_Instructions:
        This report is available only in an electronic format at the
        following URL <http://geopubs.wr.usgs.gov/open-file/of02-393>

  Distribution_Liability:
    The U.S. Geological Survey (USGS) provides these geographic
    data "as is."  The USGS makes no guarantee or warranty
    concerning the accuracy of information contained in the
    geographic data.  The USGS further makes no warranties,
    either expressed or implied, as to any other matter
    whatsoever, including, without limitation, the condition of
    the product or its fitness for any particular purpose.  The
    burden for determining fitness for use lies entirely with
    the user.  Although these data have been processed
    successfully on computers at the USGS, no warranty, expressed
    or implied, is made by the USGS regarding the use of these data
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    or imply any such warranty.

    In no event shall the USGS have any liability whatsoever
    for payment of any consequential, incidental, indirect,
    special, or tort damages of any kind, including, but not
    limited to, any loss of profits arising out of use of or
    reliance on the geographic data or arising out of the
    delivery, installation, operation, or support by USGS.

    The digital geologic map GIS of the Quiburis Formation
    and adjacent units is not meant to be used or displayed at
    any scale larger than 1:24,000 (for example, 1:12,000 or
    1:2,000).

  Standard_Order_Process:
    Digital_Form:
      Digital_Transfer_Information:
        Format_Name: ARCE; TAR
        Format_Information_Content:
          This spatial digital database includes a geologic linework arc
          attribute table, quib24k.aat, that relates to the quib24k.co3,
          quib24k.st3, quib24k.lgu, and quib24k.ref files and a rock
          unit polygon attribute table, quib24k.pat, that relates to the
          quib24k.ru and quib24k.ref files.  There is also an associated
          point table, quib24kp.pat, that relates to quib24kp.sym and
          quib24k.ref.  Other files associated with labeling and symbols
          are also included.  Quib24k.pdf contains a complete list of
          files.  A set of the same coverages in geographic format
          (quib24kg) is also part of the package.
        File_Decompression_Technique:
          Files need to be extracted from the TAR archive and .e00 files
```

```
          must be imported into ArcInfo, ArcView, or other software that
          can manage export files.  An .AML file is provided to assist
          in the import process.
        Transfer_Size: 16.1 megabytes
      Digital_Transfer_Option:
        Online_Option:
          Computer_Contact_Information:
            Network_Address:
              Network_Resource_Name:
                <http://geopubs.wr.usgs.gov/open-file/of02-393>
          Access_Instructions:
            To obtain copies of the digital data, do one of
            the following:
            1.  Download the digital files from the USGS
            public access World Wide Web site on the Internet:
            URL = http://geopubs.wr.usgs.gov/open-file/of02-393/
            2.  Anonymous FTP from geopubs.wr.usgs.gov. in the
            directory pub/open-file/of02-393
    Fees: none
Metadata_Reference_Information:
  Metadata_Date: 20021010
  Metadata_Contact:
    Contact_Information:
      Contact_Organization_Primary:
        Contact_Organization: U.S. Geological Survey
        Contact_Person: Karen Sue Bolm
      Contact_Position: Physical Scientist
      Contact_Address:
        Address_Type: mailing and physical address
        Address: 520 North Park Avenue #355
        City: Tucson
        State_or_Province: AZ
        Postal_Code: 85719
        Country: USA
      Contact_Voice_Telephone: (520) 670-5544
      Contact_Facsimile_Telephone: (520) 670-5113
      Contact_Electronic_Mail_Address: kbolm@usgs.gov
  Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial
Metadata
  Metadata_Standard_Version: FGDC-STD-001-1998
  Metadata_Access_Constraints: none
  Metadata_Use_Constraints: none
```