Preliminary integrated geologic map databases for the United States

Western States: California, Nevada, Arizona, Washington, Oregon, Idaho, and Utah
Version 1.3
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Choose state or scroll down ▼

NOTE:
This Open-File Report represents one preliminary part of a larger planned series of integrated geologic databases that will ultimately be available for the entire United States. This interim version is being released now in order to provide ready access to standardized geologic data for use in regional analyses and to meet product distribution goals. The final compilation of these state databases will allow integration of the data that are found on state-scale geologic maps, presented in a uniform database structure. This Open-File Report is similar to but will not be identical to the final version of these data.

Introduction

The growth in the use of Geographic Information Systems (GIS) has highlighted the need for regional and national digital geologic maps that have been attributed with information about age and lithology. Such maps can be conveniently used to generate derivative maps for manifold special purposes such as mineral-resource assessment, metallogenic studies, tectonic studies, and environmental research. This report is part of a series of integrated geologic map databases that cover the entire United States.

Two national-scale digital geologic maps that portray most or all of the United States already exist, King and Beikman (1974a, b), compiled at a scale of 1:2,500,000, and Reed and others (2005a, b) at a scale of 1:5,000,000. A digital version of the King and Beikman map was published by Schruben and others (1994). A simplified version of the Reed map for the United States, compiled at a scale of 1:7,500,000 is also available (Reed and Bush, 2004). The present series of maps is intended to provide the next step in increased detail.

In the conterminous United States (CONUS), state geologic maps that range in scale from 1:100,000 to 1:1,000,000 are available for most of the country, and digital versions of these state maps are the basis of this product. In a few cases, new digital compilations were made, based on other sources, or existing paper maps were digitized. For Alaska and Hawaii, new maps are being compiled.

The digital geologic maps are presented in standardized formats as ARC/INFO export files and as ArcView shapefiles. Five data tables that relate the map units to detailed lithologic and age information accompany these GIS files. The maps for the CONUS have been fitted to a common set of state boundaries based on the 1:100,000 topographic map series of the United States Geological Survey (USGS). When the maps are merged, the combined attribute tables can be used directly with the merged maps to make derivative maps. No attempt has been made to reconcile differences in mapped geology across state lines.

Procedures

The various digital geologic maps that form the basis for this product have been produced in a wide variety of formats. Although most of them were available as ArcGIS coverages or shapefiles, the items and formats in the polygon attribute tables (PATs) and arc attribute tables (AATs) vary dramatically. To unify these disparate maps, it was necessary to create a set of standard formats, and then to convert the state digital geologic maps to conform to those standards. The details of those standards are presented in the accompanying documentation. The creation of a unique map unit name called *unit_link* allows the different State maps to be merged. (Database field names are in *italics*). *Unit_link* consists of a two-letter State code, concatenated with the original map unit name, sometimes slightly modified, followed by a semicolon, and an integer that designates geographic regions (provinces) within the map, if they were used. This variable, *unit_link*, can then be used as a key field to relate the tables that contain age and lithologic information to the spatial database.

Compilation of a regional geologic map always requires compromises between the complexity of geologic information about a large region, and the need to keep the compiled map, and its explanation, relatively simple. Similarly, compromises were necessarily made to convert the large variety of formats in our source maps into the standard set of formats we used.

Typically, the spatial databases were modified from the source databases in the following general manner. The most recent data was obtained and the arcs and polygons were reattributed according to the nomenclature adopted for this series (see documentation in this report and the metadata for individual spatial databases). When this reattribution was complete, the other non-standard attributes from the original coverage were deleted. Generally, if faults were not an integral part of the coverage, arcs were retagged to make them so. However, a separate fault database is also provided.

Error correction is an ongoing process with most spatial databases. A typical state database consists of tens of thousands of polygons and arcs, and errors introduced during the creation are inescapable. One common type of error is data coding that does not conform to the original paper map. For example, polygons may be given the wrong map unit, or faults may be called normal faults instead of thrust faults. Some of these are unavoidable; in many cases, the original paper map cannot be read accurately.

In many cases, newer information is available that can be used to better describe the existing polygons and arcs that are based on decades-old compilations. This type of updating was done for some, but not all, of the maps. All changes to the source maps are documented in the new databases and metadata.

The standardized attribute tables were generated by extracting information from the legends of the source map and entering it into a set of tables that record map unit information (STunits), lithologic information (STlith), age information (STage), and references (STref and STref-link). In many cases, the existing map legends were inadequate to provide the level of information we wanted to compile. In these cases, we consulted the scientific literature, maps at larger scales, and, in some cases, the original authors of the compilations or other regional experts. Thus, the age and lithology information in the attribute tables may, in some cases, conflict with the information on the legends of the original source maps that may have been compiled decades ago.

In particular, the lithology table may be much more extensive than the information in the map legends. Large regional compilations like these State maps often utilize map units that encompass a variety of lithologies. Volcanic rocks are commonly “lumped” extensively, combining tuffs, ash-flow tuffs, flows, and subvolcanic intrusions of a number of compositions, so that map units commonly contain dozens of unique lithologies. Although we have designated a dominant (most abundant) lithology for all units, users seeking to use this information are advised to be cautious, as many map units are very poorly represented by a single lithology.

Spatial databases are provided in both Lambert Conformal Conic Projection and decimal degrees.

ArcView files can be viewed with the free viewer, ArcExplorer, which can be downloaded from http://www.esri.com/software/arcexplorer/.

References

King, P.B., and Beikman, H.M., 1974a, Geologic map of the United States: U.S. Geological Survey, scale 1: 2,500,000.

King, P.B., and Beikman, H.M., 1974b, Explanatory text to accompany the geologic map of the United States: U.S. Geological Survey Professional Paper 901, 40 p.

Reed, J.C. and Bush, C.A., 2004, Generalized Geologic Map of the Conterminous United States, U.S. Geological Survey, scale 1:7,500,000. (URL http://pubs.usgs.gov/atlas/geologic/)

Reed, J.C., Jr., Wheeler, J.O., and Tucholke, B.E., 2005a, Geologic map of North America: Geological Survey of America, Decade of North American Geology, 3 sheets, scale 1:5,000,000.

Reed, J.C., Jr., Wheeler, J.O., and Tucholke, B.E., 2005b, Geologic map of North America – Perspectives and explanation: Geological Survey of America, Decade of North American Geology, 28 p.

Schruben, P.G., Arndt, R.E., and Bawiec, W.J., 1994, Geology of the Conterminous United States at 1:2,500,000 Scale — A Digital Representation of the 1974 P.B. King and H.M. Beikman Map, U.S. Geological Survey Digital Data Series 11, release 2. (URL http://pubs.usgs.gov/dds/dds11/)

California

The paper map of California (Jennings and others, 1977) is at a scale of 1:750,000. This map is available from the California Geological Survey (CGS). It is accompanied by a detailed explanatory text (Jennings, 1985).

A digital representation of this map (Saucedo and others, 2000) is available from the CGS on a compact disc. The digital representation was produced as a cooperative venture between the USGS and the CGS over a period of several years in the late 1990s. Information for obtaining the CGS products can be found at: http://www.consrv.ca.gov/cgs/index.htm.

Data Modifications

The coverage in the present product has been modified from Saucedo and others (2000) in several important ways. The description and referencing of these changes is tabulated in the metadata.

Even though the coverage has been through extensive review, we relabeled 8 polygons to conform to the printed map. These have a *source* of CA202 in the polygon attribute table. During rectification of arc errors, we also created 9 new polygons, and gave them a label to conform to the printed map. These have a *source* of CA201 in the polygon attribute table.

We made a significantly larger number of corrections to arcs. The California map is cartographically complex, and a number of idiosyncrasies in the way it was originally drafted have resulted in numerous problems in arc attribution. We made three different types of corrections to produce the current coverage from that of Saucedo and others (2000). First, 9 arcs were either added or extended to conform to the printed map's polygon representation. These adjustments have a *source* of CA101 in the arc attribute table. Second, a number of faults on the printed maps have small breaks in the printed line that were coded as scratch boundaries in Saucedo and others (2000). We have concluded that these breaks were meant to imply approximate location, and have changed the label on 281 arcs to reflect that interpretation. These adjustments have a *source* of CA102 in the arc attribute table. Finally, another group of arcs that were coded as contacts or scratch boundaries unnecessarily divided two polygons with the same label. These arcs were eliminated and the corresponding polygons consolidated.

Additional Map Units

California is a geologically complex state, encompassing parts of many tectonic provinces. Because of this, many of the individual California map units contain a wide variety of lithologies and are difficult to characterize. In addition, there have been many advancements in understanding of the regional geology since the map was compiled in the 1970s. For these reasons, we chose to subdivide many of the California map units, to allow the coherent description of groups of rocks that have common characteristics.

As an example, the map unit SO is described in the map legend as consisting of Silurian and Devonian "sandstone, shale, conglomerate, chert, slate, quartzite, hornfels, marble, dolomite, and phyllite; some greenstone." We broke this unit into SO1 (southeastern California), consisting primarily of dolomite and limestone; SO2 (eastern Sierra Nevada), consisting primarily of argillite and sandstone; and SO3 (eastern Klamath Mountains), consisting primarily of graywacke and phyllite. Each of these packages of rocks is actually of Ordovician to Devonian age, and is so coded in the CAage table. Because each map unit presents a different spectrum of lithologic variation, we were not able to use a standard group of regions to designate these additional units; each original unit's numbered new units refer to different geographical area, which are designated in the tables in the *unit_comments* field.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the California information, this is a known issue for the *strat_unit* field in the CAunits table, and for the *reference* field in the CAref table.

METADATA / TEXT		
CAmetadata.txt CAmetadata.doc CAmetadata.htm	Text file(s) containing FGDC-compliant metadata for California files	76.0 Kb 204 Kb 312 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
CAgeol_lcc.e00	file size: 48.6 Mb	CAgeol_dd.e00	file size: 48.6 Mb
CAfaults_lcc.e00	file size: 10.5 Mb	CAfaults_dd.e00	file size: 10.5 Kb

ArcView shapefiles (.shp)			
CAgeol_lcc.zip	file size: 26.5 Mb	CAgeol_dd.zip	file size: 25.6 Mb
CAfaults_lcc.zip	file size: 2.81 Mb	CAfaults_dd.zip	file size: 2.78 Mb

ATTRIBUTE TABLES FOR CALIFORNIA (.zip files)	
California FileMaker directory	file size: 244 Kb
California Comma-separated directory	file size: 60.0 Kb
California dbf files	file size: 72.0 Kb

[STATE LIST] [BACK TO TOP]

Nevada

The paper map of Nevada (Stewart and Carlson, 1976) is at a scale of 1:500,000. It was compiled as a cooperative venture between the USGS and the Nevada Bureau of Mines and Geology (NBMG). It is available from either the USGS or from the Nevada Bureau of Mines and Geology. There is an accompanying book, published by the NBMG that describes the map units in greater detail, along with the geologic history of Nevada (Stewart, 1980).

There have been several digital representations of this map. The first was published by Turner and others (1991). USGS scientists in Menlo Park and Reno have continued to improve the coverage over the last 15 years. A version published by Raines and others (1996) combined the north and south halves into one coverage, and provided line attributes and other corrections and improvements. The current version (Raines and others, 2003) incorporates faults into the coverage and has been spatially adjusted to conform to state boundaries based on the 1:100,000 topographic map series of the USGS.

Information for obtaining the NBMG products can be found at: http://www.nbmg.unr.edu/sales/pbs.htm. USGS products can be accessed via http://infotrek.er.usgs.gov/pubs/.

Data Modifications

The coverage in the present product has been modified from Raines and others (2003) in several important ways. The description and referencing of these changes is tabulated in the metadata.

Because the map has been through extensive review during the evolution of many versions since 1988, and has been recently republished, no further polygon label errors were discovered. One area that was equivocal on the paper map was adjusted to match more recent mapping at 1:250,000. Two dangling arcs were completed to reduce the size of two polygons. One arc lacked a *spat_obj_id*, and that was added.

In order for the symbology for linear features that have polarity, such as thrust faults, to display correctly, the polarity of the spatial feature must be known and correct. A total of 32 arcs were “flipped” to ensure that all have the correct polarity.

Because the absolute age of many of the plutonic rocks in Nevada was still uncertain at the time of compilation of the original map, many polygons were coded MZgr (Mesozoic granitic rocks) and TJgr (Tertiary through Jurassic age granitic rocks). We began to correct and update these age designations in 1989, during a mineral-resource assessment of Nevada (Cox and others, 1996). Continuing this process we compared the MZgr and TJgr polygons to the information in the National Geochronological Database (Sloan and others, 2003) to identify plutons that have been subsequently dated. Where possible, we then changed their labels to Tgr (Tertiary granitic rocks), Kgr (Cretaceous granitic rocks), Jgr (Jurassic granitic rocks), or TRgr (Triassic granitic rocks). We also had several local experts examine maps of selected areas to improve the age designations. In all, more than 200 polygons were relabeled in this way.

One important feature that is not provided for in the standards established for this series is the spatial object id, which is a unique numeric identifier for each spatial feature in the coverage. This field has been included in products from the Databases and Information Analysis project in the Western Minerals Team for some years, and derives from a similar field specified in the Digital Geologic Map Data Model, Version 4.3, also known as the North American Data Model (NADM 4.3) (http://geology.usgs.gov/dm/). The construction of this field and its uses are discussed in detail in Bedford and others (2003). Because of the utility of maintaining a unique identifier for each spatial feature through many successive versions of a digital database, we include this field, termed here as *spat_obj_id*, in an additional table, *NV_spat_obj_id.xls*.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Nevada information, this is a known issue for the *unitdesc*, *strat_unit*, and *unit_com* fields in the NVunits table, and for the *reference* field in the NVref table.

METADATA / TEXT		
	Text file(s) containing FGDC-compliant metadata for Nevada files	76.0 Kb

NVmetadata.txt NVmetadata.doc NVmetadata.htm			204 Kb 312 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
NVgeol_lcc.e00	file size: 43.8 Mb	NVgeol_dd.e00	file size: 43.8 Mb
NVfaults_lcc.e00	file size: 9.67 Mb	NVfaults_dd.e00	file size: 9.67 Kb
ArcView shapefiles (.shp)			
NVgeol_lcc.zip	file size: 15.2 Mb	NVgeol_dd.zip	file size: 14.8 Mb
NVfaults_lcc.zip	file size: 2.41 Mb	NVfaults_dd.zip	file size: 2.41 Mb

ATTRIBUTE TABLES FOR NEVADA (.zip files)	
Nevada FileMaker directory	file size: 164 Kb
Nevada Comma-separated directory	file size: 44.0 Kb
Nevada dbf files	file size: 44.0 Kb

[STATE LIST] [BACK TO TOP]

Arizona

The paper map of Arizona (Richard and others, 2000) is at a scale of 1:1,000,000. Originally compiled in the 1980s to replace an earlier 1969 version (Wilson, 1969), the map has been through several revisions. The present version is available from the Arizona Geological Survey (AGS).

There have been several digital representations of this map by the AGS. The current one is that of Richard (2002). This coverage is available as a CD from the AGS. A description of the data structure and format (Richard and Thieme, 1997) is available at http://www.azgs.state.az.us/OFR%2097-5.htm.

Information for obtaining the AGS products can be found at: http://www.azgs.state.az.us/order_info.htm.

Data Modifications

The coverage in the present product has been modified from Richard (2002) in several important ways. The description and referencing of these changes is tabulated in the file metadata.

Five polygons were relabeled to conform to the printed map. Fifteen polygons were deleted when superfluous contacts between polygons with identical attributes were eliminated.

A total of 65 arcs were relabeled to conform to the printed map, including 21 that separate two polygons with the same label.

In order for the symbology for linear features that have polarity, such as thrust faults, to display correctly, the polarity of the spatial feature must be known and correct. A total of 171 arcs were “flipped” to ensure correct polarity.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Arizona information, this is not a known issue.

METADATA / TEXT		
AZmetadata.txt AZmetadata.doc AZmetadata.htm	Text file(s) containing FGDC-compliant metadata for Arizona files	76.0 Kb 204 Kb 312 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
AZgeol_lcc.e00	file size: 17.9 Mb	AZgeol_dd.e00	file size: 17.9 Mb
AZfaults_lcc.e00	file size: 2.32 Mb	AZfaults_dd.e00	file size: 2.32 Mb
ArcView shapefiles (.shp)			
AZgeol_lcc.zip	file size: 10.4 Mb	AZgeol_dd.zip	file size: 10.0 Mb
AZfaults_lcc.zip	file size: 604 Kb	AZfaults_dd.zip	file size: 588 Kb

ATTRIBUTE TABLES FOR ARIZONA (.zip files)	
Arizona FileMaker directory	file size: 160 Kb
Arizona Comma-separated directory	file size: 24.0 Kb
Arizona dbf files	file size: 28.0 Kb

[STATE LIST] [BACK TO TOP]

Washington

The paper map of Washington, at a scale of 1:500,000, was published more than 40 years ago (Hunting and others, 1961). This map is now out-of-print, but copies are sometimes available from the Washington State Department of Natural Resources (WSDNR). Out-of-print items are made available 'first-come, first-served'; e-mail lee.walkling@wadnr.gov for current availability. Subsequent to the initiation of this project, paper maps of Washington geology at a scale of 1:250,000 have also become available from WSDNR (http://www.dnr.wa.gov/geology/gmaps250.htm).

A digital representation of this map was compiled by the U.S. Geological Survey (Raines and Johnson, 1996). This is the digital map that was used as a starting point for the present product.

Information for obtaining WSDNR products can be found at: http://www.dnr.wa.gov/.

Data Modifications

The coverage in the present product has been modified from Raines and others (1996) in several important ways. The description and referencing of these changes is tabulated in the metadata.

Fourteen polygons were relabeled to conform to the printed map. In addition, 13 new polygons were created to conform to the printed map, along with the appropriate arcs.

Although the Washington map is more than 40 years old, no attempts were made to update and correct polygon labels to reflect current knowledge. This map will eventually be superseded by digital versions of the 4 quadrant maps of the state at a scale of 1:250,000.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Washington information, this is a known issue only for the *reference* field in the WAref table and for *unit_com* field in the WAunits table.

METADATA / TEXT		
WAmetadata.txt WAmetadata.doc WAmetadata.htm	Text file(s) containing FGDC-compliant metadata for Washington files	76.0 Kb 204 Kb 312 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
WAgeol_lcc.e00	file size: 15.2 Mb	WAgeol_dd.e00	file size: 15.2 Mb
WAfaults_lcc.e00	file size: 504 Kb	WAfaults_dd.e00	file size: 504 Kb
ArcView shapefiles (.shp)			
WAgeol_lcc.zip	file size: 8.55 Mb	WAgeol_dd.zip	file size: 8.23 Mb
WAfaults_lcc.zip	file size: 136 Kb	WAfaults_dd.zip	file size: 136 Kb

ATTRIBUTE TABLES FOR WASHINGTON (.zip files)	
Washington FileMaker directory	file size: 192 Kb
Washington Comma-separated directory	file size: 56 Kb
Washington dbf files	file size: 60 Kb

[STATE LIST] [BACK TO TOP]

Oregon

The paper map of Oregon (Walker and MacLeod, 1991) is at a scale of 1:500,000. This map is available from the U.S. Geological Survey. A digital representation of this map (Miller and others, 2003) is also available from the U.S. Geological Survey at http://geopubs.wr.usgs.gov/open-file/of03-67/.

The state of Oregon has embarked on a long-term project, the Oregon Geologic Data Compilation (OGDC), to digitally compile geologic data for the entire state that brings together the best available geologic mapping from state and federal agency sources, student thesis work, and consultants. This information, which is a work in progress, is available from the Oregon Department of Geology and Mineral Industries (DOGAMI) at http://www.oregongeology.com/sub/ogdc/index.htm. Information in the OGDC database was used to verify and update the digital database in this report.

Data Modifications

The coverage in the present product has been modified from Miller and others (2003) in several important ways. The description and referencing of these changes is tabulated in the metadata.

Because this map went through extensive review during the preparation of the digital database (Miller and others, 2003), only minor relabeling of polygons was necessary to make the database conform to the printed map. One polygon was relabeled from KJg to KJi to rectify a typographical error; this polygon has a *source* of OR201 in the polygon attribute table. We did make an attempt to reduce the number of polygons with queried designations. Twenty-seven queried polygons were updated with information in the OGDC; these have a *source* of OR202 in the polygon attribute table. The queries were removed from 38 additional polygons on the basis of geographic distribution in the context of the entire map; these have a *source* of OR203 in the polygon attribute table. A number of tiny “sliver” polygons were removed.

In order for the symbology for linear features that have polarity, such as thrust faults, to display correctly, the polarity of the spatial feature must be known and correct. One change in arc polarity was necessary for Oregon. In a few cases, we had to extend a few arcs to close polygons to make them conform to the paper map. There are a number of extraneous arcs in the coverage that unnecessarily divide two polygons of the same map unit. We converted all these non-fault contacts to ARC-CODE 8. These changes are identified and documented by the *SOURCE* code in the polygon attribute table and in the metadata.

Additional Map Units

Oregon is a geologically complex state, encompassing parts of several tectonic provinces. Because of this, some of the individual Oregon map units contain a wide variety of lithologies and are difficult to characterize. In addition, there have been many advancements in understanding of the regional geology since the map was compiled in the 1970s. For these reasons, we chose to subdivide 12 of the Oregon map units, to allow the coherent description of groups of rocks that have common characteristics.

As an example, the map unit Js is described in the map legend as consisting of Jurassic "mudstone, shale, siltstone, graywacke, andesitic to dacitic water-laid tuff, porcelaneous tuff, and minor interlayers and lenses of limestone and fine-grained sediments metamorphosed to phyllite or slate ." We broke this unit into Js1 (Klamath Mountains), which includes Galice Formation and unnamed hornblende- and pyroxene-bearing clastic rocks, and Js2 (300 km away, in east-central Oregon), which includes a different set of stratigraphic units. Most of these differences are between Mesozoic and Paleozoic rocks in the Klamath Mountains, in southwestern Oregon, and similar-age rocks in the eastern part of the state. In all cases the suffix for the Klamath Mountains is 1, with 2 referring to another part of the state. The general geographic area where these map units occur is designated in the tables in the unit_comments field.

We determined that the map unit Ks in western Oregon should have been tagged Kc, and made that change.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255 th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Oregon information, this is a known issue for the *unitdesc*, *strat_unit, unit_com* field in the ORunits table, and for the *reference* field in the ORref table.

METADATA / TEXT		
ORmetadata.txt ORmetadata.doc ORmetadata.htm	Text file(s) containing FGDC-compliant metadata for Oregon files	28.0 Kb 68.0 Kb 40.0 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
ORgeol_lcc.e00	file size: 28.7 Mb	ORgeol_dd.e00	file size: 28.7 Mb
ORfaults_lcc.e00	file size: 6.50 Mb	ORfaults_dd.e00	file size: 6.50 Mb
ArcView shapefiles (.shp)			
ORgeol_lcc.zip	file size: 9.76 Mb	ORgeol_dd.zip	file size: 9.41 Mb
ORfaults_lcc.zip	file size: 2.34 Mb	ORfaults_dd.zip	file size: 2.33 Mb

ATTRIBUTE TABLES FOR OREGON (.zip files)	
Oregon FileMaker directory	file size: 324 Kb
Oregon Comma-separated directory	file size: 72.0 Kb
Oregon dbf files	file size: 72.0 Kb

[STATE LIST] [BACK TO TOP]

Idaho

The paper map of Idaho (Bond, 1978) is at a scale of 1:500,000. It is available from the Idaho Geological Survey at: http://www.idahogeology.org/Products/default.htm.

The digital representation of the map is by Johnson and Raines (1996), and was created specifically to facilitate lithologic mapping. For the original map, the faults were scribed on a separate layer, and these register imperfectly with their corresponding contacts (polygon boundaries). The incorporation of the faults into the GIS representation of the map unavoidably created numerous small "sliver" polygons near these faults that have proven impractical to remove. The map is available from the U.S. Geological Survey at: http://pubs.er.usgs.gov/usgspubs/ofr/ofr95690/.

Data Modifications

The coverage in the present product has been modified from Johnson and Raines (1996) in several important ways. The description and referencing of these changes is tabulated in the metadata.

The legend for the paper map (Bond, 1978) presented special problems in conversion to our standardized format. There are no unit names or descriptions as such, only short descriptions of the general type of material and sometimes where it occurs in the state. We placed this information verbatim into the *unitdesc* field of the units table, while compiling a new description of the rocks we include in the unit for the *unit_name* field. Because there was so little information in the existing explanation, we compiled almost all the information for the age and lith tables from the geologic literature, in effect, creating a new legend that attaches a lot of new information from the 191 references we consulted to the existing unit designations. Most of the reorganization of the legend is a result of abundant new radiometric age data that were not available in the 1970s. For example, areas that were simply coded as Precambrian on the original map are now assigned to the Paleoproterozoic (X), Mesoproterozoic (Y), or Neoproterozic (Z), and new map units were created to accommodate these designations. These changes are documented in the *source* field of the polygon attribute table, and are listed in the accompanying table IDGEOL_LCC.SOURCE, which can be joined to the polygon attribute table using the key field *source*.

In addition, information about geographic features and named geologic features was compiled for the Idaho map. This information is included in the accompanying table IDGEOL_LCC.FEATURE, which can be joined to the polygon attribute table using the key field *idgeol_lcc-id*.

A few open polygons were discovered during checking of the map for errors. These were closed and the resulting new polygons were attributed with the appropriate map unit by inspection of the paper map. Some new water polygons were created along the western boundary of the map, due to topological complications arising from adjusting the map to fit the standard boundary files.

In order for the symbology for linear features that have polarity, such as thrust faults, to display correctly, the polarity of the spatial feature must be known and correct. No changes in arc polarity were necessary for Idaho. There are a number of extraneous arcs in the coverage that unnecessarily divide two polygons of the same map unit. We converted all these (that are not faults) to *ARC-CODE* 8. These changes are identified and documented by the *SOURCE* code in the polygon attribute table and in the metadata.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255 th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Nevada information, this is a known issue for the *strat_unit*, and *unit_com* fields in the IDunits table, and for the *reference* field in the IDref table.

METADATA / TEXT		
IDmetadata.txt IDmetadata.doc IDmetadata.htm	Text file(s) containing FGDC-compliant metadata for Idaho files	28.0 Kb 64.0 Kb 92.0 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		**Geographic coordinates**	
IDgeol_lcc.e00	file size: 19.5 Mb	IDgeol_dd.e00	file size: 19.4 Mb
IDfaults_lcc.e00	file size: 2.71 Mb	IDfaults_dd.e00	file size: 2.70 Mb
ArcView shapefiles (.shp)			
IDgeol_lcc.zip	file size: 7.12 Mb	IDgeol_dd.zip	file size: 6.89 Mb
IDfaults_lcc.zip	file size: 984 Kb	IDfaults_dd.zip	file size: 980 Kb

ATTRIBUTE TABLES FOR IDAHO (.zip files)

Idaho FileMaker directory	file size: 268 Kb
Idaho Comma-separated directory	file size: 72.0 Kb
Idaho dbf files	file size: 72.0 Kb

[STATE LIST] [BACK TO TOP]

Utah

The paper map of Utah (Hintze, 1980) is at a scale of 1:500,000. It is available from the Utah Geological Survey at: http://mapstore.utah.gov/geomaps.htm.

The digital representation of the map is by Hintze and others (2000). The map is available as a CD-ROM from the Utah Geological Survey at: http://mapstore.utah.gov/geomaps.htm. There are also two books available that describe the geology of Utah and serve to supplement the maps: Geologic History of Utah (Hintze, 1988) and Geology of Utah (Stokes, 1986).

Data Modifications

The coverage in the present product has been modified from Hintze and others (2000) in several important ways. The description and referencing of these changes is tabulated in the metadata.

The legend for the paper map (Hintze, 1980) presented special problems in conversion to our standardized format. There are no map unit names or unit descriptions, only a series of 8 stratigraphic columns that are annotated with map unit information and that portray lithology pictorially. The 8 stratigraphic columns refer to 8 geographic regions of Utah that are portrayed in a general way on an accompanying sketch map. For many of the units, the stratigraphic and lithologic information is significantly different for the 8 regions. The stratigraphic columns do not include information for Quaternary surficial deposits nor for igneous rocks.

In some cases, there is information in the stratigraphic column for a map unit in a particular region but no polygons of that map unit occur within the region. In other cases, a map unit that occurs within a particular region is missing from the corresponding stratigraphic column.

We created an overlay to identify the regions and systematically assigned a region code, or province, to each polygon for map units for which we had, or could develop, regional information about age and/or lithology. Then we created map unit names for each of the resulting 190 map units. Additional information about age and lithology was then incorporated into the UTunits, UTage, and UTlith tables using information gathered from the 107 references in the UTref table.

A few open polygons were discovered during checking of the map for errors. These were closed and the resulting new polygons were attributed with the appropriate map unit by inspection of the paper map.

In order for the symbology for linear features that have polarity, such as thrust faults, to display correctly, the polarity of the spatial feature must be known and correct. No changes in arc polarity were made for Utah. There are a number of extraneous arcs in the coverage that unnecessarily divide two polygons of the same map unit. We converted all these (that are not faults) to *ARC-CODE* 8. These changes are identified and documented by the *SOURCE* code in the polygon attribute table and in the metadata.

Notes on attribute data

Some of the fields in this database contain large amounts of information, and this results in some complications with using the data in GIS. The dbf format restricts each field to a maximum width of 255 characters, and the fields are simply truncated after the 255th character. The csv format makes no such restriction, but ArcGIS will either not display tables that contain fields larger than this or will display them incorrectly. For the Utah information, this is a known issue only for the *reference* field in the UTref table.

METADATA / TEXT		
UTmetadata.txt UTmetadata.doc UTmetadata.htm	Text file(s) containing FGDC-compliant metadata for Utah files	28.0 Kb 64.0 Kb 44.0 Kb

SPATIAL DATA Arc Export (.e00) files			
Lambert Conformal Conic projection		Geographic coordinates	
UTgeol_lcc.e00	file size: 50.1 Mb	UTgeol_dd.e00	file size: 50.1 Mb
UTfaults_lcc.e00	file size: 5.18 Mb	UTfaults_dd.e00	file size: 5.17 Mb

ArcView shapefiles (.shp)			
UTgeol_lcc.zip	file size: 21.8 Mb	UTgeol_dd.zip	file size: 20.8 Mb
UTfaults_lcc.zip	file size: 1.79 Mb	UTfaults_dd.zip	file size: 1.78 Mb

ATTRIBUTE TABLES FOR UTAH (.zip files)	
Utah FileMaker directory	file size: 208 Kb
Utah Comma-separated directory	file size: 36.0 Kb
Utah dbf files	file size: 40.0 Kb

[STATE LIST] [BACK TO TOP]

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[STATE LIST] [BACK TO TOP]