Geologic map of the Chewelah 30’ x 60’ quadrangle, Washington and Idaho

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Prepared in cooperation with
WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES

Miscellaneous Field Studies Map MF-2354

2000

U. S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

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INTRODUCTION

General

Miscellaneous Field Studies Map MF-2354 contains a digital geologic map database of the Chewelah 30’ x 60’ quadrangle that includes:

1. ARC/INFO (Environmental Systems Research Institute, http://www.esri.com) version 7.1.1 coverages of the various components of the geologic map

2. PostScript files to plot:
    a. The geologic map on a metric topographic base, and two detailed cross sections.
    b. A single page containing a Correlation of Map Units diagram, an abbreviated Description of Map Units, an index map, a regional structure map, and modal diagrams for most granitic units.

3. Portable Document Format (.pdf) files of:
    a. This Readme; includes in Appendix I, data contained in chew_met.txt.
    b. A detailed Description of Map Units, including references.
    c. The same page as described in 2b.

The PostScript file containing images of the Correlation of Map Units (CMU) and abbreviated Description of Map Units (DMU) is included to compliment the geologic map, and it is recommended that it be plotted to accompany plots of the map. The CMU/DMU page is also included as a .pdf file for convenient on-screen viewing, but the .pdf file will not produce as high quality a plot as the corresponding PostScript file.

The Correlation of Map Units and abbreviated Description of Map Units is in the editorial format of USGS Miscellaneous Investigations Series (I-series) maps. Within the geologic map data package, map units are identified by standard geologic map criteria such as formation-name, age, and lithology. Even though this is an author-prepared report, it has undergone a geologic names edit, and every attempt has

been made to closely adhere to the stratigraphic nomenclature of the U. S. Geological Survey. Detailed information and descriptions of units can be obtained from the Description of Map Units accessible by viewing or plotting the .pdf file of the Description of Map Units (3b above). If roads in some areas, especially forest roads that parallel topographic contours, do not show well on plots of the geologic map, we recommend use of the Chewelah 30' X 60' topographic quadrangle (48117-A1-TM-100) in conjunction with the geologic map.

This README file describes the digital data, such as types and general contents of files making up the database, and includes information on how to extract and plot the map and accompanying graphic file. Metadata information can be accessed at http://geo-nsdi.er.usgs.gov/cgi-bin/publication?map-mf and are included in Appendix I, Readme.

HOW TO OBTAIN PAPER PLOTS

For those having access to large-format plotters such as HP650C, HP755C, and HP2500C, plots may be made directly from the included plot files. For those needing paper plots of the geologic map and accompanying text, but who do not have access to large-format plotters, please contact the U.S. Geological Survey Plot-on-demand facility.

Phone: 1-888-ASK-USGS (1-888-275-8747)

DATABASE CONTENTS

The files constituting the geologic map database of this Miscellaneous Field Studies Map are listed below along with the interchange files from which they are extracted.

Data Package

All files listed below are in a compressed tar file named **chew.tar.gz** (6 MB); see section below titled, SOFTWARE UTILITIES.

ARC/INFO interchange files	Chewelah files	Contains
chew_geo.e00	**chew_geo**	Contacts, faults, geologic unit labels
chew_pts.e00	**chew_pts**	Attitudes and their dip values. Dip values plotted as annotation.
chew_xs.e00	**chew_xs**	lines of cross sections
chew_ldr.e00	**chew_ldr**	unit label leaders
chew_hyps.e00	**chew_hyps**	Topography
chew_trans.e00	**chew_trans**	Roads, cultural information
lines.rel.e00	**lines.rel**	Line dictionary
points.rel.e00	**points.rel**	Point dictionary
scamp2.shd.e00	**scamp2.shd**	SCAMP shade set
ASCI text file		
readme.txt		Readme text (this file)

The directory, info/, is produced in the process of importing interchange files to ARC coverages in ARC/INFO. The **chew** (Chewelah) info/ directory contains:

Feature Attribute tables

Polygon attribute table **chew_geo.pat**

Arc attribute tables	**chew_geo.aat** **chew_hyps.aat** **chew_trans.aat** **chew_xs.aat** **chew_ldr.aat**
Point attribute table	**chew_pts.pat**

Additional tables*

lines.rel	Dictionary, contains all SCAMP line codes (Matti and others, 1998a)
points.rel	Dictionary, contains all SCAMP point codes (Matti and others, 1998b)

*These tables contain complete dictionary information for both lines and points.

Plot Package

PostScript plot files of the geologic map and cross sections, and a CMU/abbreviated DMU diagram; please see section below titled, SOFTWARE UTILITIES for additional information.

Compressed file	Resultant image	Contains
chew.ps.gz	**chew.ps**	PostScript plot file of geologic map and cross sections
chewcmu.ps.gz	**chewcmu.ps**	PostScript plot file of CMU/DMU page

PostScript files are compressed UNIX files requiring gzip to uncompress them.

The uncompressed PostScript file **chew.ps** will plot a 1:100,000 scale, full color geologic map of the Chewelah quadrangle that includes topography, hydrography (partial) and transportation information derived from Digital Line Graphs (DLGs). The partial hydrography is hand digitized, and is part of the **chew_geo** coverage; it is not derived from a DLG. Two detailed cross sections are also included on this page. A separate sheet contains a detailed CMU diagram, an abbreviated DMU, sketch maps, and modal diagrams for granitic rocks. This sheet is in the editorial format of the U.S. Geological Survey's Miscellaneous Investigations (I) map series. The CMU/DMU sheet is approximately 45 X 32 inches in size. Both the map sheet and the CMU/DMU sheet have been successfully plotted on Hewlett-Packard large-format plotters, models HP650C, HP755CM, and HP2500C.

Other files

README.pdf	This document in .pdf format
chewdmu.pdf	DMU, CMU, sketch maps, and modal diagrams
chewddmu.pdf	Detailed Description of Map Units

SOFTWARE UTILITIES

Files which have .gz file extension were compressed using gzip. Gzip utilities are available free of charge via the internet at the gzip home page, http://www.gzip.org

The data package is additionally bundled into a single tar (tape archive) file. Individual files must be extracted using a tar utility, available free of charge via the internet through links on the Common Internet File Formats page, http://www.matisse.net/files/formats.html. One such utility is WinZip, available at http://www.winzip.com (WinZip can also decompress files).

Files in the plot package have been prepared to produce optimum plots using the shade, and marker sets listed below. The marker and line sets may be obtained at the web site

http://wrgis.wr.usgs.gov/docs/ncgm/scamp/scamp.html. GeoAge Symbol Font Family –may be obtained at the web site may be found in the following anonymous FTP area:

Server:	onyx.wr.usgs.gov	
User ID:	anonymous	
Password:	your email address	
Directory:	pub/wpg/supplies/geoage/mac	(for Macintosh fonts)
Directory:	pub/wpg/supplies/geoage/unix_and_nt	(for INIX and Windows)

geoscamp2.lin	Lines
geoscamp2.mrk	Points
scamp2.shd	Colors
geology2.shd	Patterns
GeoAge fonts	Stratigraphic Age Symbols

HOW TO OBTAIN THE DIGITAL FILES

The export files, and subsequently the data and plot files, constituting the geologic map database of this Miscellaneous Field Studies Map may be obtained in two ways, both over the Internet.

1. The files can be obtained via the Web from Western Region Geologic Information Server. Go to the web page at http://wrgis.wr.usgs.gov/miscellaneousfieldstudiesmap/mf-2354 and follow the directions to download the files.

2. The files can also be obtained by anonymous ftp over the Internet from wrgis.wr.usgs.gov. The files are located in the directory /pub/miscellaneousfieldstudiesmap/mf-2354. Be sure to use binary transfer mode.

HOW TO EXTRACT THE GEOLOGIC MAP DATABASE FROM THE TAR FILE

After downloading the files, they must be uncompressed using a gzip utility such as gzip itself or WinZip. The data files must then be extracted using a tar utility.

Digital database

To do this	Type this at the Unix command prompt
Make a 32 MB tar file named chew.tar	gzip -d **chew.tar.gz** (or use gzip utility of choice)
Go to the directory that will hold the directory **chew** (if different from local_directory)	cd local_directory
Extract the **chew** directory from the tar file	tar -xvbv {path to tar file} **chew.tar** (or use tar utility of choice)

This process will create a directory, **chew**/, that contains the ARC/INFO interchange files and supporting files. The directory should contain the following files:

chew/
- **chew_geo.e00**
- **chew_pts.e00**
- **chew_hyps.e00**
- **chew_trans.e00**
- **chew_xs.e00**
- **chew_ldr.e00**

The following are not included in the database tar file, and are downloaded separately

README.pdf	This document
chewdmu.pdf	DMU, CMU, sketch maps, and modal diagrams
chewddmu.pdf	Detailed Description of Map Units

PostScript plot files

Make a 40 MB uncompressed file, **chew.ps** by typing gzip -d **chew.ps.gz** (or use gzip utility of choice)

Portable Document Format (.pdf) files

PDF files are not stored as gzip files. They are accessed using Adobe Acrobat Reader software, available free from the Adobe website http://www.adobe.com. Follow instructions at the website to download and install the software. Acrobat Reader contains an on-line manual and tutorial.

HOW TO CONVERT THE ARC/INFO INTERCHANGE (EXPORT) FILES

The ARC interchange (.e00) files are converted to ARC coverages using the ARC command IMPORT.

ARC interchange files can also be read by some other Geographic Information Systems, including ArcView (ESRI) and MapInfo (http://www.mapinfo.com) (Environmental Systems Research Institute, Inc, 1991). Please consult your GIS documentation to see if you can use ARC interchange files and the procedure to import them.

DIGITAL GEOLOGIC MAP SPECIFICATIONS

Digital and geologic compilation of geologic map

The geologic map was compiled from geologic maps of eight 1:48,000 15'-quadrangle-blocks, each of which were made by mosaicing and reducing the four constituent 7.5' quadrangles. These 15'-quadrangle-blocks were mapped chiefly at 1:24,000 scale, but the detail of the mapping was governed by the intention that it was to be compiled at 1:48,000 scale. The compilation at 1:100,000 scale entailed necessary simplification in some areas and combining of some geologic units. Overall, however, despite a greater than two times reduction in scale, most geologic detail found on the 1:48,000 maps is retained on the 1:100,000 map. Geologic contacts across boundaries of the 8 constituent quadrangles required minor adjustments, but none significant at the final 1:100,000 scale. Even though all of the source geologic data are from significantly larger scale maps, the 1:100,000 scale compilation in this report is intended for use at that scale; digital or plotted enlargments of all or part of the map were not intended and could result in misleading map data.

The geologic map was compiled on a base-stable cronoflex copy of the Chewelah 30' X 60' topographic map and then scribed. The scribe guide was used to make a 0.007"-thick blackline clear-film, which was scanned at 1200 DPI by Optronics Specialty Company, Northridge, California. This raster image was converted to vector and polygon GIS layers and minimally attributed by Optronics Specialty Company. Minor hand-digitized additions were made at the USGS. Lines, points, and polygons subsequently edited at the USGS used standard ARC/INFO commands. Digitizing and editing artifacts significant enough to display at a scale of 1:100,000 were corrected.

Base map

Hypsography (topography), and transportation data were converted from 1:100,000 DLGs (prepared by and available from The National Cartographic Information Center) to ARC/INFO coverages. Hydrologic data is limited to major or essential features to avoid clutter in areas of finely detailed geology, and was hand digitized from a base-stable cronoflex copy of the Chewelah 30' X 60' topographic map.

Spatial resolution

Use of this digital geologic map database should not violate the spatial resolution of the data. Although the digital form of the data removes the constraint imposed by the scale of a paper map, the detail and accuracy inherent in map scale are also present in the digital data. The fact that this database was compiled and edited at a scale of 1:100,000 means that higher resolution information may not have been uniformly retained in the dataset. Plotting at scales larger than 1:100,000 will not yield greater real detail, although it may reveal fine-scale irregularities below the intended resolution of the database. Similarly, although higher resolution data is incorporated in most of the map, the resolution of the combined output will be limited by the lower resolution data.

Map accuracy standards

All contacts on the geologic map are shown as solid lines. Because uniform National geologic map accuracy standards have not yet been developed and adopted, lines and points on the Chewelah 30' X 60' geologic map follow standards currently being used by the Southern California areal mapping project (SCAMP) for 1:100,000 scale maps; lines and points that are located to within ±50 meters, relative to accurately located features on the base map, are considered to meet map accuracy standards. Published and unpublished mapping used on the Chewelah 30' X 60' geologic map are known to generally meet this map accuracy standard.

Database specifics

General—The map database consists of ARC coverages which are stored in UTM projection (Table 1). Digital tics define a 15-minute grid of latitude and longitude that corresponds to alternate corners of the 32 1:24,000 7.5' quadrangles encompassed by the Chewelah 30' x 60' quadrangle.

Table 1—Map Projection

Projection	UTM
Zone	11
Zunits	No
Units	Meters
Spheroid	Clark 1866
X shift	0.0000000000
Y shift	-5,000,000.00

The content of the geologic database can be described in terms of feature classes that include lines, points, and areas that comprise the map. See metadata text file (Appendix I) for detailed descriptions.

Lines—Lines are recorded as strings of arcs and are described in an arc attribute table. Lines represent contacts and faults which define the boundaries of map units, boundaries of open bodies of water, and map boundaries.

Polygons—Geologic map units (polygons) are described in the polygon attribute table. Using a system developed under the Southern California Areal Mapping Project (SCAMP), geologic maps can be encoded with detailed, polygon-specific geologic information on a polygon-by-polygon basis, so that within a quadrangle, lateral variations in a particular map unit can be recorded in the map database. Detailed encoding of polygons is not available in this version of the Chewelah quadrangle, but will be in the next version. For traditional descriptions of the map units, see the Portable Document Format file **chew_dmu.pdf** or **chew_ddmu.pdf**. List of map units in database is given in Appendix I.

Points—Point information (attitudes of planar and linear features) is recorded as coordinate and related information and is given in Appendix I.

REFERENCES

Environmental Systems Research Institute, Inc, 1991, ARC/INFO command references 6.0: Proprietary software manual

Matti, J.C., Powell, R.E., Miller, F.K., Kennedy, S.A., Ruppert, K.R., Morton, G.L., and Cossette, P.M., 1998a, Geologic-line attributes for digital geologic map databases produced by the Southern California Areal Mapping Project (SCAMP), Version 1.0: U.S.Geological Survey Open-File Report 97-861

Matti, J.C., Miller, F.K., Powell, R.E., Kennedy, S.A., Bunyapanasarn, T.P., Koukladas, Catherine, Hauser, R.M., and Cossette, P.M., 1998b, Geologic-point attributes for digital geologic map databases produced by the Southern California Areal Mapping Project (SCAMP), Version 1.0: U.S.Geological Survey Open-File Report 97-859

APPENDIX I
(Original metadata text)

Identification Information:

Citation:
Citation Information:
Originator: Fred K. Miller
Publication Date: 2000
Title:
Geologic Map of the Chewelah 30' x 60' quadrangle, Washington and Idaho
Edition: Version 1.0
Geospatial Data Presentation Form: vector digital data
Series Information:
Series Name: U.S. Geological Survey Miscellaneous Field Investigations
Issue Identification: USGS MF-2354
Publication Information:
Publication Place: Menlo Park, California
Publisher: U.S. Geological Survey
Online Linkage: URL: http://geopubs.wr.usgs.gov/docs/wrgis/mf-map.html

Description:

Abstract:
This data set maps and describes the geology of the Chewelah 30' X 60' quadrangle, Washington and Idaho. Created using Environmental Systems Research Institute's ARC/INFO software, the data base consists of the following items: (1) a map coverage containing geologic contacts and units, (2) a point coverage containing site-specific geologic structural data, (3) two coverages derived from 1:100,000 Digital Line Graphs (DLG); one of which represents topographic data, and the other, cultural data, (4) two line coverages that contain cross-section lines and unit-label leaders, respectively, and (5) attribute tables for geologic units (polygons), contacts (arcs), and site-specific data (points). In addition, the data set includes the following graphic and text products: (1) A PostScript graphic plot-file containing the geologic map, topography, cultural data, and two cross sections, and on a separate sheet, a Correlation of Map Units (CMU) diagram, an abbreviated Description of Map Units (DMU), modal diagrams for granitic rocks, an index map, a regional geologic and structure map, and a key for point and line symbols; (2) PDF files of the Readme text-file and expanded Description of Map Units (DMU), and (3) this metadata file.

The geologic map database contains original U.S. Geological Survey data generated by detailed field observation and by interpretation of aerial photographs. The map was compiled from geologic maps of eight 1:48,000 15' quadrangle blocks, each of which was made by mosaicing and reducing the four constituent 7.5' quadrangles. These 15' quadrangle blocks were mapped chiefly at 1:24,000 scale, but the detail of the mapping was governed by the intention that it was to be compiled at 1:48,000 scale. The compilation at 1:100,000 scale entailed necessary simplification in some areas

and combining of some geologic units. Overall, however, despite a greater than two times reduction in scale, most geologic detail
found on the 1:48,000 maps is retained on the 1:100,000 map. Geologic contacts across boundaries of the eight constituent quadrangles required minor adjustments, but none significant at the final 1:100,000 scale.

The geologic map was compiled on a base-stable cronoflex copy of the Chewelah 30' X 60' topographic base and then scribed. The scribe guide was used to make a 0.007 mil-thick blackline clear-film, which was scanned at 1200 DPI by Optronics Specialty Company, Northridge, California. This image was converted to vector and polygon GIS layers and minimally attributed by Optronics Specialty Company. Minor hand-digitized additions were made at the USGS. Lines, points, and polygons were subsequently edited at the USGS by using standard ARC/INFO commands. Digitizing and editing artifacts significant enough to display at a scale of 1:100,000 were corrected. Within the database, geologic contacts are represented as lines (arcs), geologic units as polygons, and site-specific data as points. Polygon, arc, and point attribute tables (.pat, .aat, and .pat, respectively) uniquely identify each geologic datum.

Purpose:

The data set for the Chewelah 30' X 60' quadrangle has been jointly prepared by the U.S. Geological Survey Mineral Resource Program, the Southern California Areal Mapping Project (SCAMP), and the Washington Division of Geology and Earth Resources, as part of an ongoing effort to utilize a Geographical Information System (GIS) format to create regional digital geologic databases. These regional databases are being developed as contributions to the National Geologic Map Database of the National Cooperative Geologic Mapping Program of the USGS.

The digital geologic map database for the Chewelah 30' X 60' quadrangle has been created as a general-purpose data set that is applicable to other land-related investigations in the earth and biological sciences. For example, it can be used for mineral resource evaluation studies, animal and plant habitat studies, and soil studies in the Colville and Kaniksu National Forests. The database is not suitable for site-specific geologic evaluations.

Time Period of Content:
- Time Period Information:
  - Range of Dates/Times:
    - Beginning Date: 19630701
    - Ending Date: 19891009
- Currentness Reference: New data

Status:
- Progress: Complete
- Maintenance and Update Frequency: As needed

Spatial Domain:
- Bounding Coordinates:
  - West Bounding Coordinate: -117.90475192
  - East Bounding Coordinate: -117.00015348
  - North Bounding Coordinate: -41.8011956
  - South Bounding Coordinate: -42.30937889

Keywords:
- Theme:
  - Theme Keyword Thesaurus: None
  - Theme Keyword: geologic map
  - Theme Keyword: geology
  - Theme Keyword: bedrock geology
  - Theme Keyword: surficial geology
- Place:

Place Keyword Thesaurus: None
Place Keyword: Washington and Idaho
Place Keyword: Stevens, Pend Oreille, Spokane, and Bonner Counties
Place Keyword: Chewelah 30' X 60' quadrangle

Access Constraints: None

Use Constraints:
The Chewelah 30' X 60' geologic-map database should be used to evaluate and understand the geologic character of the Chewelah 30' X 60' quadrangle as a whole. The data should not be used for purposes of site-specific land-use planning or site-specific geologic evaluations. The database is sufficiently detailed to identify and characterize geologic materials and structures. However, it is not sufficiently detailed for site-specific determinations.

Use of this digital geologic map database should not violate the spatial resolution of the data. Although the digital form of the data removes the constraint imposed by the scale of a paper map, the detail and accuracy inherent in map scale are also present in the digital data. The fact that this database was compiled and edited at a scale of 1:100,000 means that higher resolution information may not have been uniformly retained in the dataset. Plotting at scales larger than 1:100,000 will not yield greater real detail, although it may reveal fine-scale irregularities below the intended resolution of the database. Similarly, although higher resolution data is incorporated in most of the map, the resolution of the combined output will be limited by the lower resolution data.

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Country: United States of America
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Contact Facsimile Telephone: (509) 368-3199
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Data Set Credit:
Technical review by Rowland Tabor and Kenneth Fox led to significant improvements that eventually were reflected in aspects of the database, the plot file, and in the description of the geologic units of the Chewelah 30' X 60' quadrangle.

Geologic mapping and digital preparation of this report were sponsored jointly by (1) the National Cooperative Geologic Mapping Program of the U.S. Geological Survey, (2) the Washington Division of Geology and Earth Resources, (3) the Southern California Areal Mapping Project (SCAMP), and (4) the Mineral Resources Program of the U.S. Geological Survey. In our digital preparation of the data set, carried out in the Geographic Information System laboratory of the Mineral Resources Program of the U.S. Geological Survey in Spokane, Washington by Pamela M. Cossette and Pamela D. Derkey, we received valuable assistance from Paul C. Hyndman and from Rachel Hauser at the SCAMP Geographic Information System laboratory in Riverside, California.

Native Data Set Environment:
SunOS, 5.6, sun4u UNIX
ARC/INFO version 7.2.1

Cross Reference:
Citation Information:
Originator: Stephanie Z. Waggoner
Publication Date: 1990
Title:
Geologic Map of the Chewelah 30’ X 60’ quadrangle, Washington and Idaho
Geospatial Data Presentation Form: map
Series Information:
Series Name:
Washington Division of Geology and Earth Resources Open File Report
Issue Identification: Open File Report 90-14
Publication Information:
Publication Place: Olympia, Washington
Publisher: Washington State Department of Natural Resources

Data Quality Information:
Attribute Accuracy:
Attribute Accuracy Report:
Geologic-map units in the Chewelah quadrangle database were described using standard field methods. Consistent with these methods, the database author has assigned standard geologic attributes to geologic lines, points, and polygons identified in the database.

Nation-wide geologic-map accuracy standards have not been developed and adopted by the U.S. Geological Survey and other earth-science entities. Until such standards are adopted, the SCAMP project has developed internal map-accuracy standards for 1:100,000-scale geologic maps produced by the project.

Geologic lines and points on 1:100,000 scale geologic maps are judged to meet SCAMP's internal map-accuracy standards if they are located to within +/-50 meters, relative to topographic or cultural features on the base map.

Lines and points that meet (or may not meet) this SCAMP internal map-accuracy standard are identified both in the digital database and on derivative geologic-map plots. Within the database, line and point data that are judged to meet the SCAMP internal map-accuracy standard are denoted by the attribute code .MEE. (meets) in the appropriate data table; line and point data that may not meet the SCAMP internal map-accuracy standard are denoted by the attribute code .MNM. (may not meet).

On any derivative geologic-map plot, line data that are judged to meet the SCAMP internal map-accuracy standard are denoted by solid lines; line data that may not meet the SCAMP internal map-accuracy standard are denoted by dashed or dotted lines. There is no cartographic device for denoting the map-accuracy for geologic-point data (eg. symbols representing bedding, foliation, lineations, etc.).

Logical Consistency Report:
Polygon and chain-node topology present.

The areal extent of the map is represented digitally by an appropriately projected (UTM projection), mathematically generated box. Consequently, polygons intersecting the lines that comprise the map boundary are closed by that boundary. Polygons internal to the map boundary are completely enclosed by line segments which are themselves a set of sequentially numbered coordinate pairs. Point data are represented by coordinate pairs.

Completeness Report:
The geologic map and digital database of the Chewelah 30'x 60' quadrangle contain new data that have been subjected to rigorous review and are a substantially complete representation of the current state of knowledge concerning the geology of the quadrangle.

Positional Accuracy:
Horizontal Positional Accuracy:
Horizontal Positional Accuracy Report:
The maximum transformation RMS error acceptable for 30' x60' quadrangle transformation and data input is 0.003 (7.6 meters). Horizontal positional accuracy was checked by visual comparison of hard-copy plots with base-stable source data.

Transformation data for the Chewelah quadrangle are as follows:

Scale (X,Y) = (2540.622,2540.193) Skew (degrees) = (0.004)
Rotation (degrees) = (-0.377) Translation = (421268.260,311632.232)
RMS Error (input,output) = (0.003,7.674)

Affine X = Ax + By + C
Y = Dx + Ey + F

A = 2540.567	B = 16.874	C = 421268.260
D = -16.718	E = 2540.137	F = 311632.232

Lineage:
Process Step:
Process Description:
Field mapping and aerial photograph interpretation; iterative process (F.K. Miller).
Process Date: 1963-1974; 1987-1989

Process Step:
Process Description:
Transfer of geologic linework and point data from field maps and aerial photographs to a scale-stable cartographic base of quadrangle (scribeguide) (F.K. Miller).
Process Date: 1989
Process Step:
Process Description:
The geologic map information was scanned (initial raster scan in MS-DOS TIF format, 1200 dots per inch) from a clear-film, right-reading, 0.007 mil thickness, base-stable blackline positive (made by contact photograph from a scribeguide) of the author-prepared geologic map at 1:100,000 scale. The raster scan was auto-vectorized, converted to an ARC/INFO coverage using standard ARC/INFO commands, and minimally attributed by Optronics Specialty Company, Inc. Preliminary attribution and editing was completed in Spokane by Mineral Resource Program personnel (P.D. Derkey).
Process Date: 1997
Process Step:
Process Description:
ARC/INFO database revised; polygon, arc and point attribute tables updated using model established for SCAMP coverages. Digitizing and editing artifacts significant enough to display at a scale of 1:100,000 were corrected (P.M. Cossette).
Process Date: 1998-2000
Process Step:
Process Description:
The two coverages that provide base map reference data (hypsography/topography, and transportation/cultural information) were derived from USGS 1:100,000-scale DLGs available on the Web: URL: edcwww.cr.usgs.gov/glis/glis.html
Process Date: 1999
Process Step:

Process Description:
First draft of metadata created by P.Cossette using FGDCMETA.AML ver. 1.2 06/13/98 on ARC/INFO data set /pool5/c/cossette2/chewelah/chew_geo0609
Process Date: 20000613

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: 3269
SDTS Point and Vector Object Type: String
Point and Vector Object Count: 7795
SDTS Point and Vector Object Type: GT-polygon composed of chains
Point and Vector Object Count: 3270

Spatial Reference Information:
Horizontal Coordinate System Definition:
Planar:
Grid Coordinate System:
Grid Coordinate System Name: Universal Transverse Mercator
Universal Transverse Mercator:
UTM Zone Number: 11
Transverse Mercator:
Scale Factor at Central Meridian: 1.0
Longitude of Central Meridian: -117.50
Latitude of Projection Origin: 48.00
False Easting: 0.000
False Northing: -5,000,000 meters
Planar Coordinate Information:
Planar Coordinate Encoding Method: coordinate pair
Coordinate Representation:
Abscissa Resolution: 7.455918788909
Ordinate Resolution: 7.455918788909
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:
Overview Description:
Entity and Attribute Overview:
Version 1.0 of the Chewelah 30' x 60' geologic map database comprises six coverages, of which two contain geologic data, two contain DLG derived geo-reference data, and two contain cartographic line entities.

Geologic data represented by line entities and the polygons they delineate are contained in the coverage CHEW_GEO. For display purposes, the geology coverage contains two annotation subclasses: anno.geo contains unit labels, and anno.fault contains formal, fault names.

Feature attribution and item definitions are as follows:

CHEW_GEO.PAT:

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	

9	CHEW_GEO#	4	5	B	-
13	CHEW_GEO-ID	4	5	B	-
17	LABL	35	35	C	-
52	PLABL	35	35	C	-
87	SHDPS	3	3	I	-
90	SHDFIL	3	3	I	-
93	NAME	320	320	C	-

LABL geologic map unit label, in plain text

The following geologic units (LABL) and their corresponding names (NAME) are identified in the Chewelah 30' x 60'quadrangle:

Qm	Mine tailings
Qls	Landslide deposits
Qag	Galcial and alluvial deposits
QTs	Consolidated alluvial and (or) glacial deposits
Tcl	Clay deposits
Tcr	Columbia River Basalt Group
Tt	Tiger Formation
Tcs	Conglomerate and sedimentary breccia
Tcb	Chlorite breccia and cataclastic rocks associated with the Newport Fault
Tcc	Tectonic breccia of Cusick Creek
Tbl	Cataclastic rocks of Bayley Lake
Ts	Sanpoil Volcanics
Thd	Hypabyssal dikes
Tsp	Silver Point Quartz Monzonite
Tam	Quartz monzodiorite of Ahern Meadows
Tll	Quartz monzonite of Loon Lake
To	O'Brien Creek Formation
Kmm	Monzogranite of Midnight Mine
Klr	Monzogranite of Little Roundtop
Kbgm	Muscovite monzogranite of Blue Grouse Mountain
Ksh	Starvation Flat Quartz Monzonite, hornblende-biotite monzogranite and granodiorite
Ksha	Starvation Flat Quartz Monzonite, Arden pluton
Kfl	Fan Lake Granodiorite
Kc	Biotite monzogranite of Camden
Kdc	Two-mica granodiorite of Dubius Creek
Kgp	Galena Point Ganodiorite
Kb	Blickensderfer Quartz Monzonite
Khlc	Granodiorite of Hall Mountain, Loop Creek pluton
Kpl	Phillips Lake Granodiorite
Kli	Leucocratic intrusive rocks
Knb	Two-mica monzogranite of North Basin
Knc	Monzogranite of Narcisse Creek
Kbm	Monzogranite of Big Meadows
Koc	Monzogranite of Otter Creek
Klgs	Leucocratic granitic rocks of Scotia
Ksv	Granodiorite of Spring Valley
Kbr	Two-mica monzogranite of Blanchard Road
KJcc	Hornblende-biotite quartz diorite of Cusick Creek
Jlm	Quartz monzodiorite of Lane Mountain
MzPzf	Fault-zone rocks
JTrft	Flowery Trail Granodiorite
MCu	Carbonate and clastic sedimentary rocks, undivided

Ml	Limestone
MD3	Dolomite and slate
MD2	White and pale-gray dolomite
MD1	Dark-gray dolomite
Ddl	Dolomite and limestone
Ol	Ledbetter Formation
OCgc	Phyllite and quartzite of Gardiner Creek
OCmu	Metaline Formation, undivided part
OCms	Metaline Formation, shaly limestone member
OCmd	Metaline Formation, thick-bedded dolomite member
OCml	Metaline Formation, thick- and thin-bedded limestone member
OCmld	Metaline Formation, dark-gray dolomite beds
OCmq	Metaline Formation, limestone and carbonate-bearing quartzite member
CZau	Addy Quartzite, undivided part
Cau	Addy Quartzite, upper member
Cac	Addy Quartzite, coarse-grained member
CZap	Addy Quartzite, purple member
Zal	Addy Quartzite, lower member
Zmu	Monk Formation, undivided part
Zma	Monk Formation, argillite member
Zmc	Monk Formation, conglomerate member
Zmg	Monk Formation, greenstone member
Zhg	Huckleberry Formation, greenstone member
Zhgc	Huckleberry Formation, volcanic conglomerate
Zhi	Huckleberry Formation, intrusive greenstone
Zhc	Huckleberry Formation, conglomerate member
Ydtu	Deer Trail Group, undivided part
Ybu	Buffalo Hump Formation, undivided part
Yba	Buffalo Hump Formation, argillite
Ybq	Buffalo Hump Formation, quartzite
Ys	Stensgar Dolomite
Ym	McHale Slate
Ywcu	Wabash Detroit Formation and Chamokane Formation, undivided
Ywd	Wabash Detroit Formation
Ywdg	Wabash Detroit Formation, greenstone
Ycc	Chamokane Creek Formation, carbonate-bearing rocks
Yccq	Chamokane Creek Formation, vitreous quartzite and argillite
Yt	Togo Formation
Ybmh	Bonner Formation, Mount Shields Formation, and argillite of Half Moon Lake, undivided
Ybo	Bonner Formation
Yms5	Mount Shields Formation, Member 5
Yms4	Mount Shields Formation, Member 4
Yms3	Mount Shields Formation, Member 3
Yhm	Argillite of Half Moon Lake
Yssh	Shepard Formation, Snowslip Formation, undivided
Yssw	Shepard Formation, Snowslip Formation, and Wallace Formation, undivided
Ysh	Shepard Formation
Ywr	Wallace Formation and Ravalli Group, undivided
Yss	Snowslip Formation
Yw	Wallace Formation
Ye	Empire Formation
Ysr	St. Regis Formation
Yr	Revett Formation

Ybk	Burke Formation
Yd	Mafic sills
Yp	Prichard Formation
Ypm	Metamorphosed part of the Prichard Formation
Ynl	Newman Lake Gneiss
sgg	Schist, gneiss, and leucocratic granitic rocks

Bodies of water are designated - water body; there is no data in LABL.

PLABL coded geologic map unit label used to generate plot labels with relevant stratigraphic symbols. The geologic units with LABL designating Paleozoic (Pz), Cambrian (C), Mesozoic (Mz), and Triassic (Tr) have PLABL with substitute characters, |, _ , }, and ^ respectively, that call their corresponding symbols from the GeoAge Font Group. Geologic map unit labels will plot on derivative map plots with appropriate stratigraphic symbols if PLABL is used as the source for unit labels. The GeoAge Font Group is accessed through geofont.txt. The GeoAge Font Group and relevant information are available from the Web via anonymous FTP:

Server: onyx.wr.usgs.gov
UserId: anonymous
Passwd: your email address
Directory: /pub/wpg/supplies/geoage/mac (for Macintosh fonts)
/pub/wpg/supplies/geoage/unix_and_nt (Unix and Windows fonts)

SHDPS polygon color from shadeset scamp2.shd (included in the data package)

SHDFIL polygon fill pattern from shadeset geology2.shd (included in the data package)

NAME geologic name of each unit

Geologic lines, which include features such as faults, and contacts are attributed with the following set of feature attribute items contained in chew geo.aat. (A complete description of each line type is available in the data table, lines.rel.)

CHEW_GEO.AAT:

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	CHEW_GEO#	4	5	B	-	
25	CHEW_GEO-ID	4	5	B	-	
29	L-TAG	25	25	C	-	
54	L-SYMB	3	3	I	-	
57	L-NAME	200	200	C	-	

L-TAG line attribute which consists of a character and numerical value, e.g. C17, allows the user to relate the line entity to its corresponding definition in lines.rel

List of line types used in the Chewelah geologic map coverage (chew geo), including abbreviated descriptions from lines.rel:

C17	Contact, landslide, location meets map accuracy standard
C29	Contact, sedimentary, location meets map accuracy standard
C31	Contact, sedimentary, inferred, location may not meet map accuracy standard
C42	Contact, sedimentary, gradational, location may not meet map accuracy standard

C49	Contact, igneous, location meets map accuracy standard
C51	Contact, igneous, inferred, location may not meet map accuracy standard
58	Contact, igneous, gradational, location may not meet map accuracy standard
C67	Contact, metamorphic, inferred, location may not meet map accuracy standard
C99	Contact, igneaous, scratch boundary
CL1	Cartographic line, map boundary
CL2	Cartographic line, water boundary
F1	Fault, high angle, slip unspecified, generic, location meets map accuracy standard
F4	Fault, high angle, normal slip, location meets map accuracy standard
F5	Fault, high angle, reverse slip, location meets map accuracy standard
F7	Fault, high angle, slip unspecified, location meets map accuracy standard
10	Fault, high angle, normal slip, location may not meet map accuracy standard
F11	Fault, high angle, reverse slip, location may not meet map accuracy standard
F19	Fault, high angle, slip unspecified, inferred beneath mapped covering unit, location may not meet map accuracy standard
F22	Fault, high angle, normal slip, inferred beneath mapped covering unit, location may not meet map accuracy standard
F23	Fault, high angle, reverse slip, inferred beneath mapped covering unit, location may not meet map accuracy standard
F40	Fault, high angle, normal slip, existence questionable, inferred beneath mapped covering unit, location may not meet map accuracy standard
F83	Fault, low angle, slip unspecified, younger over older, inferred, location may not meet map accuracy standard
F84	Fault, low angle, slip unspecified, younger over older, inferred beneath mapped covering unit, location may not meet map accuracy standard
F113	Fault, low angle, normal slip, younger over older, detachment, location meets map accuracy standard
F114	Fault, low angle, normal slip, younger over older, detachment, location may not meet map accuracy standard
F116	Fault, low angle, normal slip, younger over older, detachment, inferred beneath mapped covering unit, location may not meet map accuracy standard
F87N	Fault, low angle, slip unspecified, younger over older, existence questionable, inferred beneath mapped covering unit, location may not meet map accuracy standard

L-SYMB stores appropriate line symbol value from the lineset geoscamp2.lin (included in the data package)

L-NAME formal name of fault

Geological point data includes site-specific information describing the types and the orientation of bedding, foliation, and lineations. One annotation subclass is included in the geologic points coverage, CHEW_PTS: anno.dip displays the respective dip and plunge values associated with individual point data.

Feature attribution and item definitions are as follows:

CHEW_PTS.PAT:

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	CHEW_PTS#	4	5	B	-	
13	CHEW_PTS-ID	4	5	B	-	
17	P-SYMB	3	3	I	-	
20	P-TAG	25	25	C	-	
45	P-DIP	3	3	I	-	
48	P-STRIKE	3	3	I	-	
51	P-DIPDIR	3	3	I	-	
54	P-PLUNGE	3	3	I	-	
54	P-BEARING	3	3	I	-	

P-SYMB calls the point-type from the markerset geoscamp2.mrk (included in the data package)

P-TAG point tag which consists of a character(s) and numerical value, e.g. FN42, allows the user to relate the point entity to its corresponding definition in the data table, points.rel

Point types (quantitative orientation data) in chew pts.pat and their corresponding, abbreviated descriptions from points.rel:

B1	Bedding, horizontal, sedimentary rocks
B2	Bedding, inclined, sedimentary rocks
B4	Bedding, vertical, sedimentary rocks
B6	Bedding, overturned, sedimentary rocks
B11	Bedding, wavy or crinkled, inclined, sedimentary rocks
B27	Bedding, inclined, volcanogenic rocks
FN13	Foliation, primary igneous, inclined
FN14	Foliation, primary igneous, vertical
FN42	Foliation, metamorphic, inclined
FN43	Foliation, metamorphic, vertical
CLV2	Cleavage, inclined
CLV4	Cleavage, vertical
L12	Lineation, crushed and streaked mineral grains, horizontal
L14	Lineation, crushed and streaked mineral grains, inclined
L37	Lineation, metamorphic, minor fold axis

P-DIP the dip of planar features

P-STRIKE the azimuth strike of planar features

P-DIPDIR azimuthal direction of dip

At present, it is not possible to indicate the cardinal direction of dip using traditional conventions (traditional geologic notation allows a quadrant designation following the dip value).

P-PLUNGE lineation plunge value

P-BEARING azimuthal bearing of plunge

The two coverages that provide base-map (DLG derived) geo-reference information are CHEW_HYPS (topographic contour data) and CHEW_TRANS (cultural data/roads). Both are line coverages.

In order to facilitate plotting of the topographic information available in CHEW_HYPS, original DLG-derived attribution was retained and two additional attributes added, LTYPE and ELEV. The added attributes allow the user to descriminate between, and selectively plot, contour data.

Similarly, in addition to the original DLG-derived transportation attribution available in CHEW_TRANS, three additional attributes were added, LTYPE, USROUTE, and STROUTE. They permit the user to identify and selectively plot the various road types included in the DLG data.

Cartographic line entities are contained in CHEW_XS (two cross-section traces) and CHEW_LDR (unit label leaders). These line entities have only one attribute, L-SYMB, and all have the same value, 1.

Entity and Attribute Detail Citation:

A complete description of the polygon, line, and point data coding schemes is available in U.S. Geological Survey Open-File Reports OFR 97-859, OFR 97-860, and OFR 97-861 (full source citations follow):

Matti, J.C., Miller, F.K., Powell, R.E., Kennedy, S.A., Bunyapanasarn, T.P., Koukladas, Catherine, Hauser, R.M., and Cossette, P.M., 1997b, Geologic-point attributes for digital geologic-map databases produced by the Southern California Areal Mapping Project (SCAMP), Version 1.0: U.S.Geological Survey Open-File Report 97-859

Matti, J.C., Miller, F.K., Powell, R.E., Kennedy, S.A., and Cossette, P.M., 1997c, Geologic-polygon attributes for digital geologic-map databases produced by the Southern California Areal Mapping Project (SCAMP), Version 1.0: U.S.Geological Survey Open-File Report 97-860

Matti, J.C., Powell, R.E., Miller, F.K., Kennedy, S.A., Ruppert, K.R., Morton, G.L., and Cossette, P.M., 1997a, Geologic-line attributes for digital geologic-map databases produced by the Southern California Areal Mapping Project (SCAMP), Version 1.0: U.S.Geological Survey Open-File Report 97-861

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This digital, geologic map database of the Chewelah 30' x 60' quadrangle, 1:100,000 map-scale, and any derivative maps thereof, is not meant to be used or displayed at any scale larger than 1:100,000 (e.g., 1:24,000).

Metadata Reference Information:
- Metadata Date: 20000911
- Metadata Review Date: 2000xxxx
- Metadata Contact:
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- Metadata Standard Name: FGDC-STD-001-1998
- Metadata Standard Version: Version of June 8, 1994
- Metadata Access Constraints: none
- Metadata Use Constraints: none