

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

Digital geologic map of the Rosalia 1:100,000 quadrangle, Washington and  
Idaho: a digital database for the 1990 S.Z. Waggoner map

by

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## Introduction

Geologic data from the geologic map of the Rosalia 1:100,000-scale quadrangle compiled by Waggoner (1990) were entered into a geographic information system (GIS) as part of a larger effort to create regional digital geology for the Pacific Northwest. The intent was to provide a digital geospatial database for a previously published black-and-white paper geologic map. This database can be queried in many ways to produce a variety of geologic maps. Digital base map data files 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 1:100,000 (e.g., 1:62,500 or 1:24,000).

The map area is located in eastern Washington and extends across the state border into western Idaho (Fig. 1). This open-file report describes the methods used to convert the geologic map data into a digital format, documents the file structures, and explains how to download the digital files from the U.S. Geological Survey public access World Wide Web site on the Internet.

We wish to thank J. Eric Schuster of the Washington Division of Geology and Earth Resources for providing the original stable-base mylar and the funding for it to be scanned. We also thank Dick Blank and Barry Moring of the U.S. Geological Survey for reviewing the manuscript and digital files, respectively.

## Data Sources, Processing, and Accuracy

Plate 1 from Waggoner (1990) was the sole source of geologic data used to create the digital map. The original stable-base mylar of the geologic linework for the 1:100,000-scale geologic map (Waggoner, 1990, pl. 1) was electronically scanned to create a raster digital image. The resulting TIFF-format image (600 dot per inch resolution) was registered to a UTM grid and rectified in Arc/Info. The rectified raster image was then converted to a vector GIS layer using the GRIDLINE vectorization tool included in the Arc/Info GRID extension. Subsequent clean-up of the vector layer was done in PC Arc/Info. Linework for water bodies that obscured geologic contacts was converted from digital line graph (DLG) format files (U.S. Geological Survey, 1993) to PC Arc/Info so as to delineate discrete geologic unit boundaries. The resulting geologic map was attributed, converted to Arc/Info, and then plotted and compared to the original mylar to check for digitizing and attributing errors.

Point data (strike and dip of beds, etc.) were digitized from the original mylar into GSMAP, ver. 9 (Selner and Taylor, 1993) as points in a UTM, zone 11 map projection. These data were output to Arc/Info GENERATE-format files using the GSMGIS utility (G.I. Selner, written commun., 1994). An Arc/Info point location map was then generated, attributed and annotated.

The overall accuracy (with respect to the location of lines and points) of the digital geologic map (Figs. 2 and 3) is probably no better than +/- 70 meters. This digital database is not meant to be used or displayed at any scale larger than 1:100,000 (e.g., 1:62,500 or 1:24,000).







## GIS Documentation

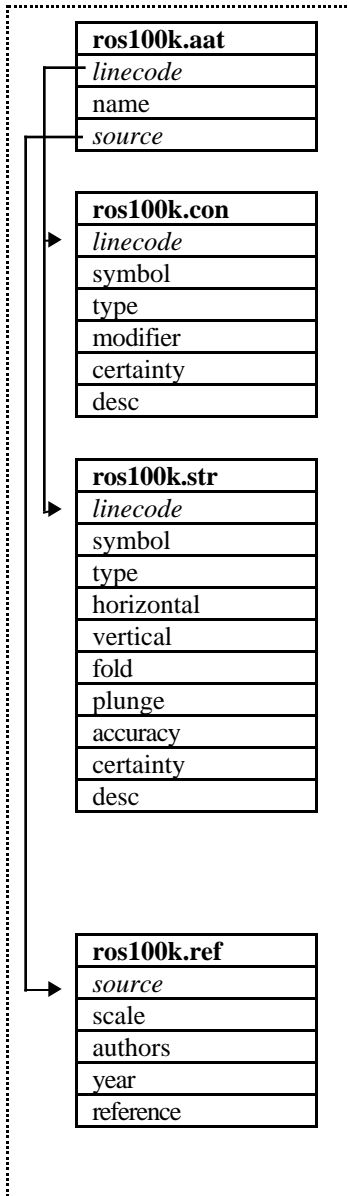
The digital geologic map of the Rosalia 1:100,000 quadrangle includes an arc (or line) attribute table, ROS100K.AAT, that relates to the ROS100K.CON, ROS100K.STR and ROS100K.REF files; a polygon attribute table, ROS100K.PAT, that relates to the ROS100K.RU and ROS100K.REF files; and a point attribute table, ROSPNT.PAT, that relates to the ROSPNT.ALC, ROSPNT.GEO and ROS100K.REF files (see Fig. 4). These data files are described below.

### ***Linear Features***

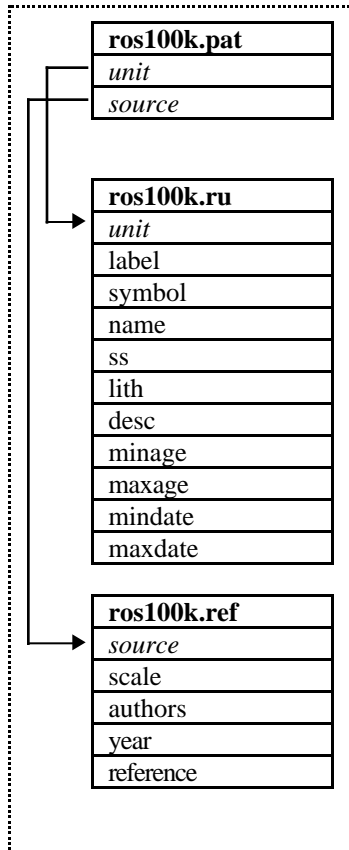
Descriptions of the items identifying linear features such as contacts, boundaries (e.g., shorelines, lines of latitude and longitude) and structures in the arc (or line) attribute table, ROS100K.AAT, are as follows:

<b>ROS100K.AAT</b>			
<b>ITEM NAME</b>	<b>ITEM TYPE</b>	<b>ITEM LENGTH</b>	<b>ATTRIBUTE DESCRIPTION</b>
<b>linecode</b>	integer	3	Numeric code used to identify type of linear feature. Linecodes < 100 are used for contacts and boundaries which are described in the <a href="#">ROS100K.CON file</a> . Linecodes > 100 and < 600 represent structural features which are described in the <a href="#">ROS100K.STR file</a> .
<b>name</b>	character	30	Name given to structural feature. No faults were named in the original source map, thus this item does not contain any names.
<b>source</b>	integer	4	Numeric code used to identify the data source for the linear feature. Complete references for the sources are listed in the <a href="#">ROS100K.REF file</a> .

Arc attribute table and related look-up tables:



Polygon attribute table and related look-up tables:



Point attribute table and related look-up tables:

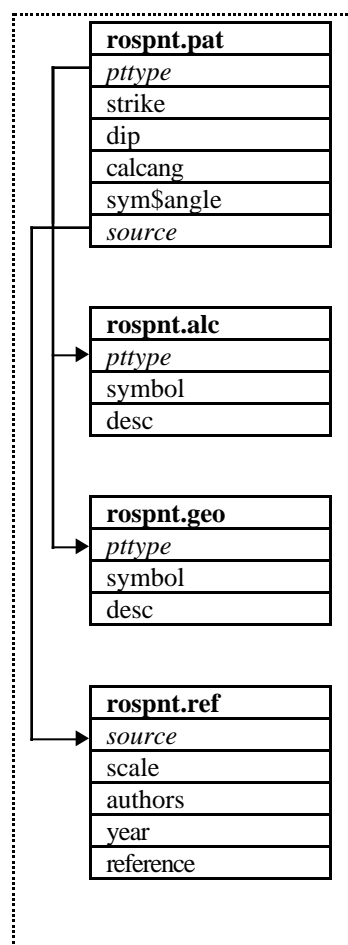


Figure 4: Relationships between feature attribute tables and look-up tables.

Attribute descriptions for items in the contact (and boundary) look-table, ROS100K.CON (for use with the PLOTTER.LIN lineset), are as follows:

<b>ROS100K.CON</b>			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>linecode</b>	integer	3	Numeric code (a value < 100) used to identify type of contact or boundary. (This item also occurs in <a href="#">ROS100K.AAT.</a> )
<b>symbol</b>	integer	3	Line symbol number used by Arc/Info to plot arc (line). (Symbol numbers refer to the <b>PLOTTER.LIN lineset.</b> )
<b>type</b>	character	10	Major type of line, e.g., contact, shoreline, lines of latitude and longitude used for neatlines.
<b>modifier</b>	character	20	Line type modifier, i.e., approximate, concealed, gradational
<b>certainty</b>	character	15	Degree of certainty of contact or boundary, i.e., inferred, uncertain. No entry implies 'certain.'
<b>desc</b>	character	100	Written description or explanation of contact or boundary.

Attribute descriptions for items in the structure look-up table, ROS100K.STR (for use with the GEOLOGY.LIN lineset), are as follows:

<b>ROS100K.STR</b>			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>linecode</b>	integer	3	Numeric code (a value > 100 and < 600) used to identify type of structural feature. (This item also occurs in <a href="#">ROS100K.AAT.</a> )
<b>symbol</b>	integer	3	Line symbol number used by Arc/Info to plot arc (line). (Symbol numbers refer to the <b>GEOLOGY.LIN lineset.</b> )
<b>type</b>	character	10	Major type of structure, i.e., fault, fracture, fold, other.
<b>horizontal</b>	character	20	Type of horizontal fault movement, e.g., left-lateral, right-lateral. No entry implies 'unknown.'
<b>vertical</b>	character	20	Type of vertical fault movement, e.g., normal. No entry implies 'unknown.'
<b>fold</b>	character	15	Type of fold, e.g., anticline, syncline.
<b>plunge</b>	character	15	Type of plunge on fold, i.e., horizontal, plunging, plunging in, plunging out.
<b>accuracy</b>	character	15	Line type modifier indicating degree of accuracy, i.e., approximately located, concealed, gradational.
<b>certainty</b>	character	15	Degree of certainty of contact or boundary, i.e., inferred, uncertain. No entry implies 'certain.'
<b>desc</b>	character	100	Written description or explanation of structural feature.

## Areal Features

Descriptions of the items identifying geologic units in the polygon attribute table, ROS100K.PAT, are as follows:

ROS100K.PAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>unit</b>	integer	4	Numeric code used to identify the rock unit which is described in the ROS100K.RU look-up table. (This item also occurs in <a href="#">ROS100K.RU</a> .)
<b>source</b>	integer	4	Numeric code used to identify the data source for the rock unit. Complete references for the sources are listed in the <a href="#">ROS100K.REF</a> file.

Attribute descriptions for items in the lithology (rock unit) look-table, ROS100K.RU (for use with the CALCOMP1.SHD shadeset), are as follows:

ROS100K.RU			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>unit</b>	integer	4	Numeric code used to identify rock unit. (This item also occurs in <a href="#">ROS100K.PAT</a> .)
<b>label</b>	character	10	Rock unit label (abbreviation) used to label unit on map.
<b>symbol</b>	integer	3	Shadeset symbol number used by Arc/Info to plot a filled/shaded polygon. (The symbol numbers used in this file refer to the <b>CALCOMP1.SHD shadeset</b> .)
<b>name</b>	character	7	The prefix portion of the geologic unit label that does not include subscripts. (If no subscripts are used in the label, then the 'name' entry is the same as the 'label' entry.)
<b>ss</b>	character	3	The suffix portion of the geologic unit label that includes subscripts.
<b>lith</b>	character	20	Major type of lithostratigraphic unit, i.e., unconsolidated sediments, sedimentary rocks, metasedimentary rocks, intrusive rocks, extrusive rocks, metamorphic rocks, water, ice.
<b>desc</b>	character	100	Formal or informal unit name
<b>minage</b>	character	7	Minimum stratigraphic age of lithologic unit, i.e., CRET, TERT, PCY.
<b>maxage</b>	character	7	Maximum stratigraphic age of lithologic unit
<b>mindate</b>	integer	4	Minimum radiometric age (in millions of years) if determined.
<b>maxdate</b>	integer	4	Maximum radiometric age (in millions of years) if determined.

The reader is referred to Waggoner (1990) for detailed descriptions of map units.

### Point Features

Descriptions of the items identifying geologic map symbols are given in the point attribute table, ROSPNT.PAT (for use with the ALCGEOL.MRK markerset), which is defined as follows:

<b>ROSPNT.PAT</b>			
<b>ITEM NAME</b>	<b>ITEM TYPE</b>	<b>ITEM LENGTH</b>	<b>ATTRIBUTE DESCRIPTION</b>
<b>pttype</b>	character	15	Type of point symbol, e.g., strike and dip of inclined bedding, strike and dip of inclined cleavage, geochemical sample location.
<b>strike</b>	integer	3	Strike of bedding, metamorphic foliation or cleavage; or geochemical sample number. Strike is an azimuthal angle (measured in degrees from 0 to 360 in a clockwise direction from North). Sample number refers to a rock sample used for geochemical analysis.
<b>dip</b>	integer	3	Dip of bedding, metamorphic 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.
<b>calcang</b>	integer	3	An interim value used to calculate sym\$angle. It turned out that the various structural map symbols in the ALCGEOL.MRK markerset had to be rotated by different amounts to achieve their proper map orientation. For the strike and dip symbols, calcang = strike - 270; for the lineation symbol, calcang = strike - 180 (however, lineation symbols were not used in this quadrangle map).
<b>sym\$angle</b>	integer	3	The angle used to complete the mathematical rotation of the structural map symbol to its proper orientation on the map. This value is the \$angle pseudoitem value for the point. For all of the map symbols, sym\$angle = 0 - calcang.
<b>source</b>	integer	4	Numeric code used to identify the data source for the geologic map symbol. Complete references for the sources are listed in the <a href="#">ROSPNT.REF file</a> .

Attribute descriptions for items in the geologic map symbols look-up table, ROSPNT.ALC (for use with the ALCGEOL.MRK markerset), are as follows:

<b>ROSPNT.ALC</b>			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>pttype</b>	character	15	Type of point symbol, e.g., strike and dip of inclined bedding, strike and dip of inclined cleavage, geochemical sample location. (This item also occurs in the <a href="#">ROSPNT.PAT file</a> .)
<b>symbol</b>	integer	3	Marker symbol number used by Arc/Info to identify type of geologic map symbol. Symbol numbers refer to the <b>ALCGEOL.MRK markerset</b> .
<b>desc</b>	character	250	Written description or explanation of map symbol.

Attribute descriptions for items in an alternate geologic map symbols look-up table, ROSPNT.GEO (for use with the GEOLOGY.MRK markerset), are as follows:

<b>ROSPNT.GEO</b>			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>pttype</b>	character	15	Type of point symbol, e.g., strike and dip of inclined bedding, strike and dip of inclined cleavage, geochemical sample location. (This item also occurs in the <a href="#">ROSPNT.PAT file</a> .)
<b>symbol</b>	integer	3	Marker symbol number used by Arc/Info to identify geologic map symbol type in the <b>GEOLOGY.MRK markerset</b> .
<b>desc</b>	character	250	Written description or explanation of map symbol.

### **Source Attributes**

Descriptive source or reference information for the ROS100K and ROSPNT coverages is stored in the ROS100K.REF and ROSPNT.REF files, respectively. Attribute descriptions for items in the ROS100K.REF and ROSPNT.REF data source files are as follows:

<b>ROS100K.REF / ROSPNT.REF</b>			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
<b>source</b>	integer	4	Numeric code used to identify the data source. (This item also occurs in the <a href="#">ROS100K.AAT</a> , <a href="#">ROS100K.PAT</a> , and <a href="#">ROSPNT.PAT</a> files.)
<b>scale</b>	integer	10	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.)
<b>authors</b>	character	100	Author(s) or compiler(s) of source map entered as last name, first name or initial, and middle initial.
<b>year</b>	integer	4	Source (map) publication date
<b>reference</b>	character	250	Remainder of reference in USGS reference format.

## Obtaining Digital Data

The complete digital version of the geologic map is available in Arc/Info EXPORT format with associated data files. These data and map images are maintained in a Universal Transverse Mercator (UTM) map projection:

Projection:	UTM
Zone:	11
Y-offset (false easting):	-5,000,000 meters
Units:	meters

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://wrgis.wr.usgs.gov/open-file/of98-\\_\\_\\_\\_/](http://wrgis.wr.usgs.gov/open-file/of98-____/)**

or

2. Anonymous FTP from **wrgis.wr.usgs.gov**, in the directory **pub/open-file/of98-\_\_\_\_/**

The Internet sites contain the digital geologic map of the Rosalia 1:100,000 quadrangle both in Arc/Info EXPORT-format files (ROS100K.e00 and ROSPNT.e00) and as an HPGL2 plot file (ROS100K.hp), as well as the associated data files and Arc/Info macro programs which are used to plot the map at a scale of 1:100,000.

To manipulate this data in a geographic information system (GIS), you must have a GIS that is capable of reading Arc/Info EXPORT-format files.

## Obtaining Paper Maps

Paper copies of the digital geologic map are not available from the USGS. However, with access to the Internet and access to a large-format color plotter that can interpret HPGL2 (Hewlett-Packard Graphics Language), a 1:100,000-scale paper copy of the map can be made, as follows:

1. Download the digital version of the complete map, **ros100k.hp**, from the USGS public access World Wide Web site on the Internet using the **URL = [http://wrgis.wr.usgs.gov/open-file/of98-\\_\\_\\_\\_/](http://wrgis.wr.usgs.gov/open-file/of98-____/)**

or

2. Anonymous FTP the plot file, **ros100k.hp**, from: **wrgis.wr.usgs.gov**, in the directory: **pub/open-file/of98-\_\_\_\_/**

3. This file can be plotted by any large-format color plotter that can interpret HPGL2. The finished plot is about 29 inches by 39 inches.

Paper copies of the map can also be created by obtaining one of the versions of the digital files as described above and then creating a plot file in a GIS.

## References Cited

- Selner, G.I. and Taylor, R.B., 1993, GSMAP, and other programs for the IBM PC and compatible microcomputers, to assist workers in the earth sciences (version 9): U.S. Geological Survey Open-File Report 93-511, 363 p.
- U.S. Geological Survey, 1993, 1:100,000-scale digital line graph (DLG) data - hydrography and transportation, Area 13 - Northwestern states: U.S. Geological Survey, US GeoData (optional format), CD-ROM.
- Waggoner, S.Z., compiler, 1990, Geologic map of the Rosalia 1:100,000 quadrangle, Washington-Idaho: Washington Division of Geology and Earth Resources Open File Report 90-7, 20 p. and 1 plate (scale 1:100,000).