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

Digital geologic map of Spokane County and vicinity, Washington and Idaho

compiled by

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Open-File Report 98-503

Prepared in cooperation with the Washington Division of Geology and Earth Resources and the Spokane County Public Works, Utilities Department

1998

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Table of Contents

INTRODUCTION......1

DATA SOURCES, PROCESSING, AND ACCURACY......1

DESCRIPTION OF MAP UNITS......5

QUATERNARY UNCONSOLIDATED DEPOSITS......5
QUATERNARY GLACIAL AND PERIGLACIAL DEPOSITS......6
CENOZOIC OR TERTIARY SEDIMENTARY AND VOLCANIC ROCKS......7
Columbia River Basalt Group......*7*
INTRUSIVE ROCKS......9
PALEOZOIC AND PROTEROZOIC METASEDIMENTARY ROCKS......12
Deer Trail Group......*12*
Belt Supergroup......*13*
HIGH GRADE METAMORPHIC ROCKS......14

GIS DOCUMENTATION......16

LINEAR FEATURES......16
AREAL FEATURES......20
POINT FEATURES......22
SOURCE ATTRIBUTES......23

OBTAINING DIGITAL DATA......23

OBTAINING PAPER MAPS......24

REFERENCES CITED......24

APPENDIX A - LIST OF DIGITAL FILES IN THE SPOKANE COUNTY GIS......26

APPENDIX B - ARC/INFO MACRO LANGUAGE PROGRAM (SPOKCO.AML) USED TO PLOT THE GEOLOGIC MAP OF SPOKANE COUNTY AND VICINITY......27

APPENDIX C - METADATA FILE (SPOKCO.MET) FOR THE SPOKANE COUNTY AND VICINITY GIS......31

List of Figures

Figure 1. Index map showing the location of Spokane County and vicinity......*2*
Figure 2. Explanation for the digital geologic map of Spokane County and vicinity......*3*
Figure 3. Digital geologic map of Spokane County and vicinity......*4*
Figure 4: Relationships between feature attribute tables and look-up tables.......*17*

Introduction

This report describes the edge-matched, digital geologic map of portions of the Chewelah, Spokane, and Rosalia 1:100,000 scale maps (Carrara and others, 1995; Joseph, 1990; Kiver and others, 1979; Miller, written communication, 1995; and Waggoner, 1990a, b). The digital representation of Spokane County was produced to aid in county land classification, hazard studies, and resource evaluations. This work was completed at the request of the Spokane County Public Works Department, Spokane, Washington. Under the requirements of the Washington State Growth Management Act, Spokane County is required to designate and protect natural resource lands of long term commercial significance. These digital geologic data for Spokane County and vicinity will better enable county agencies to predict the likely occurrence of additional mineral lands, primarily containing sand, gravel, rock and clay deposits.

The map area is located in northeastern Washington and extends across the state border into the Idaho panhandle (Fig. 1). This open-file report describes the rock units in the map area (Figs. 2 and 3) and discusses 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.

Geologic data for the southern portion of the Chewelah 1:100,000-scale quadrangle was compiled, digitized into a geographic information system (GIS), and integrated with 1:100,000-scale digital geology from the Spokane and Rosalia quadrangles (Johnson and Derkey, 1998; and Derkey and others, 1998) to create a digital geologic map for Spokane County and vicinity.

We would like to thank the Washington Division of Geology and Earth Resources and the Spokane County Public Works, Utilities Department for permitting Robert E. Derkey and Beatrice B. Lackaff, respectively, to participate and incorporate their expertise in this effort. We also thank J.G. Evans and R.J. Miller of the U.S. Geological Survey for reviewing the manuscript and digital files, respectively.

Data Sources, Processing, and Accuracy

Carrara and others (1995), Joseph (1990), Kiver and others (1979), Miller (written communication, 1995), and Waggoner (1990a, b) are the original sources of geologic data used to create this digital map. Joseph's (1990) and Waggoner's (1990b) geologic maps were previously converted to a digital format by Johnson and Derkey (1998) and Derkey and others (1998), respectively. Data from Carrara and others (1995), Miller (written communication, 1995), and Waggoner (1990a) were compiled, digitized and integrated with digital hydrography for the southern part of the Chewelah 1:100,000-scale quadrangle. Linework for water bodies that obscured geologic contacts was converted from digital line graph (DLG) format files (U.S. Geological Survey, 1993) to Arc/Info so as to complete geologic unit boundaries. The geology for each of the three quadrangles (Chewelah, Rosalia, and Spokane) was digitally edgematched based both on geologic map interpretations by B.R. Johnson and P.D. Derkey and on field observations by T.P. Frost and R.E. Derkey.

The overall accuracy of the digital geologic map (Fig. 3) is probably no better than +/- 70 meters. The 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).

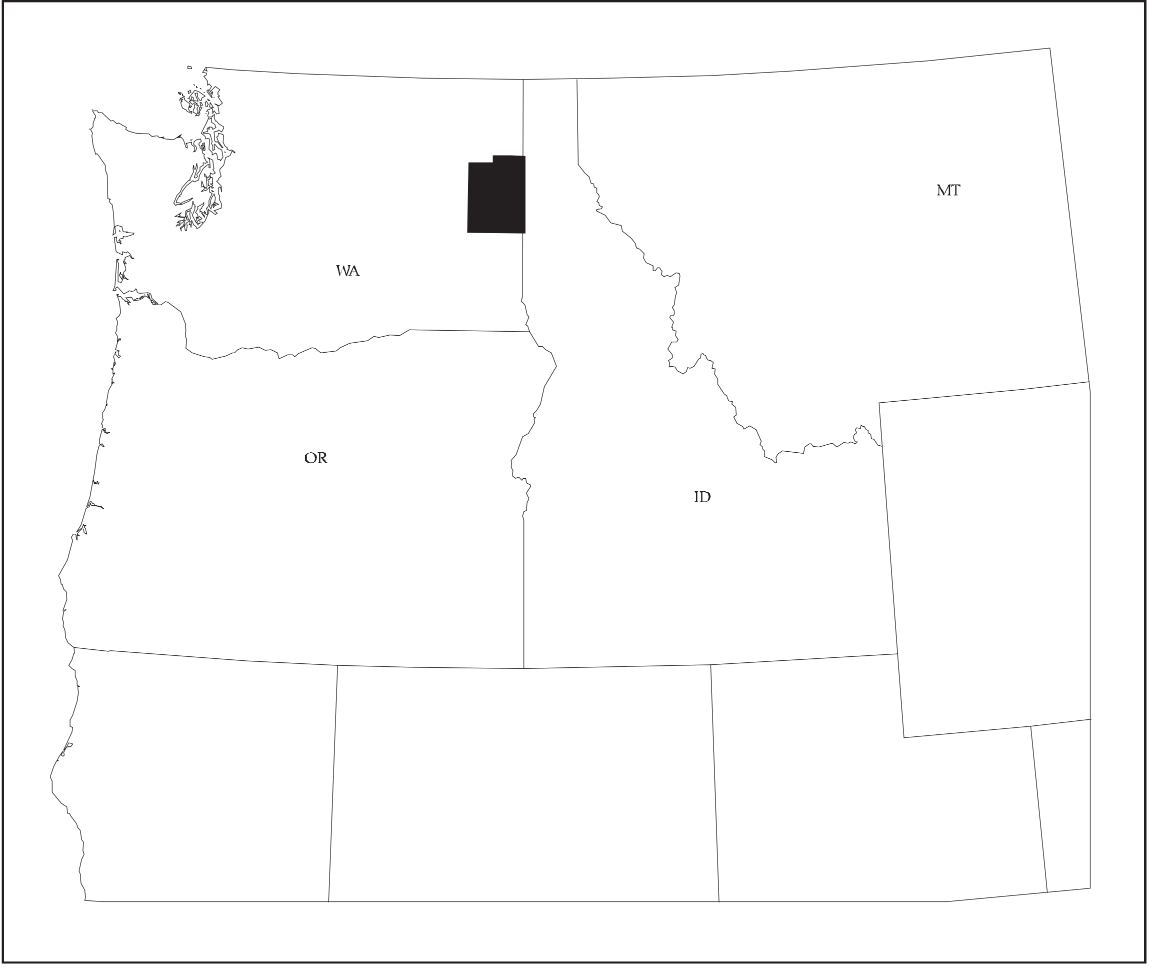

Figure 1. Index map showing the geographic extent of the mapped area (black fill) with respect to the Pacific Northwest.

QUATERNARY UNCONSOLIDATED DEPOSITS

Qa - Alluvium

Qp - Peat deposits

Qs - Sand deposits

Ql - Loess

Qls - Landslide deposits

QUATERNARY GLACIAL AND PERIGLACIAL DEPOSITS

Qgd - Glacial drift

Qglf - Glaciolacustrine and outburst flood deposits

Qgl - Glaciolacustrine deposits

Qfg - Flood deposits, gravel

CENOZOIC OR TERTIARY SEDIMENTARY AND VOLCANIC ROCKS

Tcg - Conglomerate of the Chamokane Creek area

Columbia River Basalt Group

Tvssl - basalt of Sprague Lake, Weissenfels Ridge Member of the Saddle Mountains Basalt

Tvwp - Priest Rapids Member of the Wanapum Basalt

Tvwr - Roza Member of the Wanapum Basalt

TvgN2 - Magnetostratigraphic unit N2 of the Grande Ronde Basalt

Tcl - Latah Formation

INTRUSIVE ROCKS

Td - Dikes

Tt - Granodiorite near Tumtum

Tsp - Silver Point Quartz Monzonite

Tmr - Granite of Mount Rathdrum

TKa - Alaskite, pegmatite, and aplite

TKu - Unassigned granitoids

TKqm - Unassigned quartz monzonite

TKmc - Quartz monzonite and granite near Mud Creek

TKcc - Quartz monzonite of Corkscrew Canyon

TKfm - Granite near Four Mound Prairie

Kel - Monzogranite of Eloika Lake

Km - Quartz monzonite near the Midnight mine

Kfl - Fan Lake Granodiorite

Kw - Granodiorite near Wellpinit

Ko - Quartz monzonite near Otter Creek

Kmsg - Mount Spokane Granite

Kls - Quartz monzonite near the Little Spokane River

Ksv - Granodiorite west of Spring Valley

Kc - Monzogranite of the Camden area

Klr - Monzogranite of Little Roundtop

PALEOZOIC AND PROTEROZOIC METASEDIMENTARY ROCKS

CZa - Addy Quartzite, undivided

CYu - Metasedimentary rocks, undivided

CYq - Quartzite near Edwall

Deer Trail Group

Ydq - quartzite

Ydb - Buffalo Hump Formation

Ydm - McHale Slate

Belt Supergroup

Ybu - undivided

Ybms - Striped Peak Formation, Missoula Group

Ybw - Wallace Formation, undivided

Ybwu - upper unit of the Wallace Formation

Ybwl - lower unit of the Wallace Formation

Ybr - Ravalli Group, undivided

Ybrs - St. Regis Formation of the Ravalli Group

Ybrrb - Revett and Burke formations of the Ravalli Group

Ybrr - Revett Formation of the Ravalli Group

Ybrb - Burke Formation of the Ravalli Group

HIGH-GRADE METAMORPHIC ROCKS

Knl - Newman Lake Gneiss

Kms - Deformed granite and banded mylonite gneiss of Mount Spokane; subdivided south of 47° 30′ N into Kms1 and Kms2.

Kms1 - Muscovite-megacryst-bearing granite of Mount Spokane

Kms2 - Orthogneiss of Mount Spokane

pCa - Amphibolite

pCh - Hauser Lake Gneiss

pCm - Heterogeneous metamorphic rocks

pCf - Quartzite near Freeman

pCmp - Gneiss of Mica Peak

pCrm - Gneiss near Round Mountain

pCc - Gneiss near Cable Peak

pCrl - Schist near Rock Lake

Contact

Fault

Spokane County boundary

Figure 2. Digital Geologic Map of Spokane County and vicinity, Washington and Idaho - Explanation

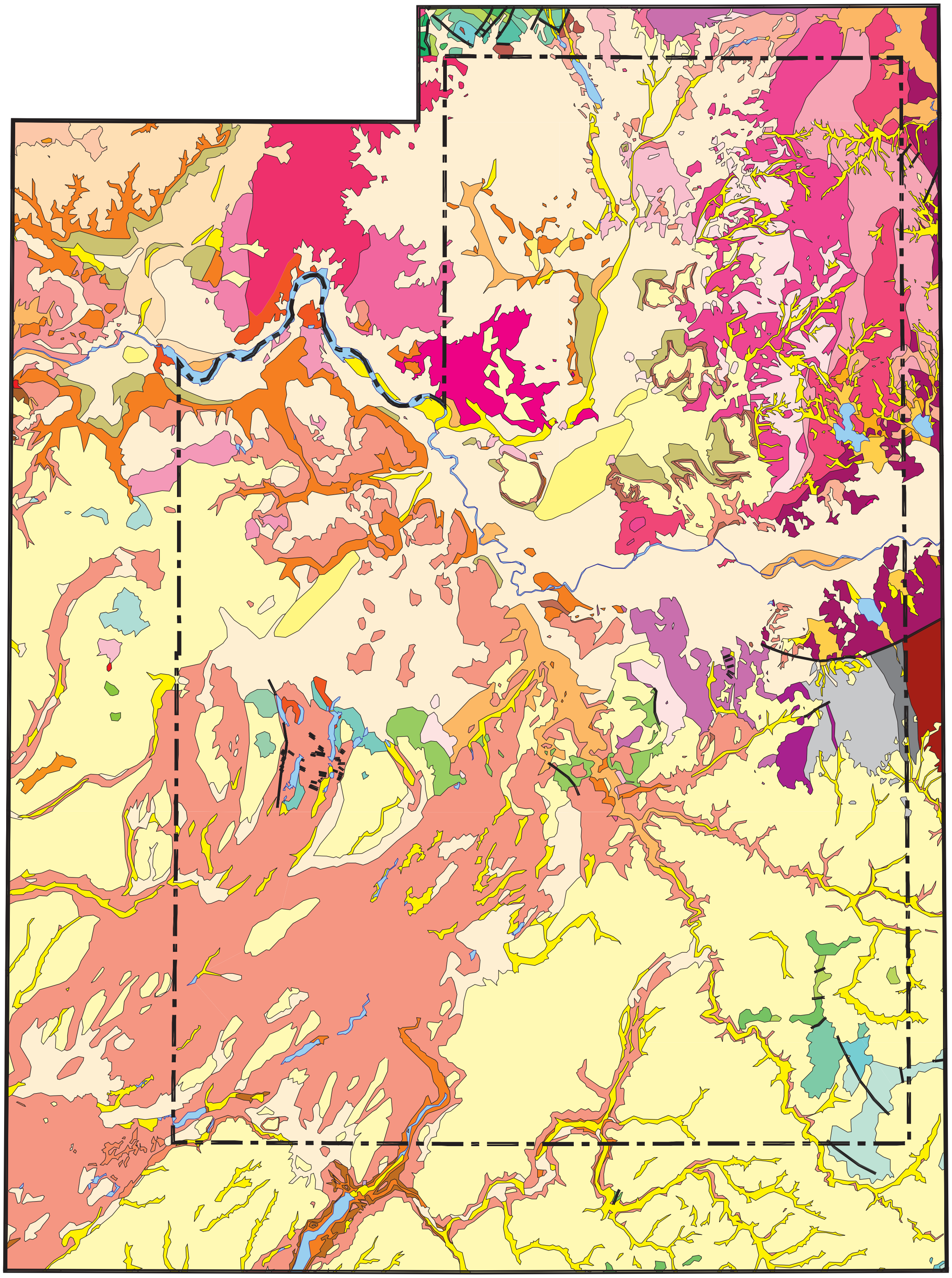

Figure 3. Digital Geologic Map of Spokane County and vicinity, Washington and Idaho

Description of Map Units

The following unit descriptions for the 1:100,000-scale geologic map of Spokane County and vicinity are combined and modified from unit descriptions for the 1:100,000-scale geologic maps for the Spokane (Joseph, 1990), Chewelah (Waggoner, 1990a), and Rosalia quadrangles (Waggoner, 1990b). Some descriptions are augmented by information from other sources and field observations. The intent of the descriptions are to highlight characteristics and differences that may be important for land management decisions, zoning, hazard potential, and resources, particularly sand, gravel, and crushed rock, not to fully document radiometric ages, stratigraphic correlations, or other traditional geologic information. For readers interested in these aspects, please refer to the source publications (Joseph, 1990; Waggoner, 1990a, b).

Quaternary Unconsolidated Deposits

Qa

Alluvium (Holocene)--Stratified to unstratified and well-sorted to poorly sorted boulders, cobbles, gravel, sand, silt, and clay in floodplains, terraces, and valley bottoms. Locally includes alluvial fan, lacustrine, paludal, organic, and eolian deposits, and discontinuous layers and lenses of volcanic ash.

Qp

Peat deposits (Holocene)--Brown to yellow-brown fibrous peat, sedimentary peat, muck, organic-rich alluvium, and local, thin volcanic ash interbeds. Typically found near lakes and in closed depressions. Only the larger deposits are shown.

Qs

Sand deposits (Holocene-Pleistocene)--Active and stabilized composed of predominantly fine, well-sorted, sub- to well-rounded quartz and basalt fragments. This unit includes the informally named Mead sand, an important resource for cement manufacture due to its uniformity in grain size and degree of rounding (J. McDonald, ACME Materials and Construction, oral communication, 1996). Equivalent to unit Qd of Joseph (1990).

Ql

Loess (Holocene-Pleistocene)--Chiefly massive eolian silt and fine sand ranging in color from light tan to yellow brown to dark red to orange brown. Older loess layers typically have deeper coloration. The loess has a maximum thickness of 23 m in Spokane County; it averages 6 m thick south of the Spokane River and thins to the north where there is more topographic relief.

In the southern part of the map area, as many as six sequences of fining upward, unconformity bounded loess layers are present. The base of a sequence consists of basaltic gravel, sand, and indurated clasts of underlying paleosols (older soils developed on previous loess deposit). The overlying quartzofeldspathic and basaltic sand dunes grade up into massive and unstratified eolian silt that typifies the unit.

Loess is most common on the tops of low hills and plateaus where erosion by water has been minimal; loess is thin to absent along the main path of the glacial floods that passed through the area.

The loess soils of eastern Washington's Palouse country are some of the world's richest agricultural lands. Although not as extensive as they are south of Spokane County, local areas in the County are equally as productive as those to the south. The fine grain size and unconsolidated nature of the loess renders it particularly susceptible to erosion by wind and water.

Qls

Landslide deposits (Holocene-Pleistocene)--Unstratified and poorly sorted clay, silt, sand, and gravel deposited by rotational and translational movements. The unit includes slumps, earthflows, rockslides, colluvium, and rockfall deposits. Some deposits contain individual blocks of basalt nearly 8 m in diameter. Deposits generally are restricted to the sides of prairies and bluffs. Some landslides are several kilometers in length and more than 1.5 km across; Latah Formation generally underlies the slides. Most deposits are covered or partially buried by Pleistocene flood deposits (Qfg) and thus appear to be late Pleistocene in age. A few landslides have been active historically.

Quaternary Glacial and Periglacial Deposits

Glaciers repeatedly developed and dissipated during the ices ages of the Pleistocene. A complex suite of sedimentary deposits from these glaciers is present in the Spokane area. They include glacial drift and related deposits from glaciers and their meltwater north of Spokane, and tremendous amounts of coarse-grained sediments from catastrophic floods that resulted from failure and then reforming of glacial-ice dams along the Clark Fork River east of Lake Pend Oreille. A majority of the preserved glacial and periglacial deposits are of the Wisconsin or latest glacial event (85,000-7,000 years); pre-Wisconsin deposits are not distinguished.

Qgd

Glacial drift (Pleistocene)--Till, outwash, and ice-contact stratified deposits in moraines, till plains, and meltwater channels and terraces deposited during the last glacial advance. As mapped, unit is restricted to northwest of Spokane County.

Qglf

Glaciolacustrine and outburst flood deposits, undivided (Pleistocene)--Glaciolacustrine deposits consisting of silt, clay, and fine sand with interbedded coarse clastic deposits of catastrophic floods. This unit is well exposed in bluffs along Latah Creek and is present elsewhere in the map area.

Qgl

Glaciolacustrine deposits (Holocene to Pleistocene)--Light-gray, friable, poorly bedded, fine sand, silt, and clay deposited in glacial lakes. Pebbles, cobbles, and boulders are locally present and probably represent stones dropped from melting ice floes. Coarse clastic material may include granitic and coarse-grained metamorphic rocks, quartzite, low grade metasedimentary rocks, and basalt.

Qfg

Flood deposits, gravel (Pleistocene)--Poorly to moderately well-sorted, massive to thick bedded, stratified deposits of boulders, cobbles, pebbles, and sand resulting from multiple episodes of catastrophic outbursts from glacially-dammed Lake Missoula. Subrounded to angular clasts of diverse lithologies locally are as large as 3 meters in diameter.

Glacial Lake Missoula formed by the damming of the present-day Clark Fork River near Sandpoint, Idaho by advancing glaciers during the ice ages. There were as many as 100 Lake Missoula flood events between 15,000 and 12,000 years ago as the ice dam repeatedly formed and failed (see Eliot and others, 1986 for a good review). The Spokane Valley was the main channelway that carried flood waters from Lake Missoula through the Spokane area. Deposits in the Spokane Valley are several hundred feet thick and are dominated by boulder- and cobble-gravel. The Little Spokane River drainage received less extensive flooding; deposits there are dominated by pebble-gravel and coarse-grained sands with local boulder- and cobble-gravel.

This unit is the principal source for construction sand and gravel in the Spokane area. Due to its high porosity and permeability it is also an outstanding aquifer. Sands and gravels of this map unit comprise the Spokane and other aquifers (see Molenaar, 1988, for an excellent review of the Spokane aquifer and its origin).

Qo

Outwash (Pleistocene)-- Dense, well-sorted, and well-stratified deposits composed mostly of sand and pebble- to cobble-sized gravel and smaller amounts fosilt and clay. Equivalent to unit Qgo of Waggoner (1990a)

Cenozoic or Tertiary Sedimentary and Volcanic Rocks

Tcg

Conglomerate (Pliocene?-Miocene?)--Well-indurated, manganese- and iron-cemented, chiefly clast-supported, poorly sorted, and poorly stratified to unstratified conglomerate. The conglomerate contains as much as 0.023 percent U_2O_3 in the matrix. In the northern part of the area, the unit overlies rocks of the Columbia River Basalt Group. Equivalent to unit PL~~M~~cg of Joseph (1990) and PL~~M~~cgc of Waggoner (1990b).

Columbia River Basalt Group

The Columbia River Basalts represent a vast outpouring of basaltic lava flows from vents in eastern Oregon and southeastern Washington and Idaho from about 17 to 6 million years ago. Two of the units exposed in Spokane County, the Wanapum and Grande Ronde, were erupted from vents in Idaho and reached the Pacific Ocean. The Columbia River Basalt cover an area of 163,000 square kilometers and are estimated to be represent nearly 175,000 cubic kilometers of lava (Tolan and others, 1989). Drainages dammed by the flows formed local lakes along the eastern margin of the basalt field. Sediments deposited in those lakes formed the Latah Formation in Spokane County.

Tsm
Saddle Mountains Basalt, Weissenfels Ridge Member, basalt of Sprague Lake (middle Miocene)--Fine-grained plagioclase-phyric basalt flow or flows with normal magnetic polarity. The basalt is gray on fresh surfaces and reddish-brown on weathered surfaces. Basalt was deposited about 12-13 million years ago in a shallow ancient valley in underlying Priest Rapids Member of Wanapum Basalt. The Saddlem Mountains basalt unit is present only in the southwesternmost part of Spokane County.

Twp
Wanapum Basalt, Priest Rapids Member (middle Miocene)--Fine- to coarse-grained basalt flows with olivine and plagioclase phenocrysts commonly are visible in hand specimen. Unit has reverse magnetic polarity and was erupted 15.3 to 14.5 million years ago. The unit overlies the Grand Ronde Basalt N_2 unit and, when present, the lakebed sediments of the Latah Formation. The Priest Rapids Member is also invasive into Latah Formation. In the Spokane area, the Priest Rapids Member forms prominent rim rock and steep cliffs, commonly with well-developed columnar jointing. The cliffs of Greenbluff and Five Mile Prairie are formed of the Priest Rapids member. Equivalent to unit ~~M~~v_{wp} of Joseph (1990) and unit ~~M~~v_{wpr} Waggoner (1990b).

Twr
Wanapum Basalt, Roza Member (middle Miocene)--Basalt flows characterized by 5 to 8 percent plagioclase phenocrysts as large as 10 mm evenly distributed as single laths. Where present, the two flows of the Roza member generally record a change from reversed to transitional magnetic polarity. The Roza Member is nowhere thicker than 50 m and is exposed only in the southwestern part of the county. It overlies Grande Ronde Basalt and underlies the Priest Rapids Member of the Wanampum Basalt. Equivalent to unit ~~M~~v_{wr} of Waggoner (1990b).

Tgr
Grande Ronde Basalt, magnetostratigraphic unit N_2 (middle Miocene)--Black to dark-gray, fine-grained, dense to slightly vesicular flows composed of dark-brown glass, plagioclase, pyroxene, minor olivine, and abundant disseminated magnetite and/or ilmenite. Individual flows are from 1 to 50 m thick, but typically are 15 to 25 m thick. Flows are commonly pillowed, indicating the basalt flowed into water. Unit has normal magnetic polarity. Flows of the Grande Ronde Basalt overlie or are invasive into the Latah Formation; where Latah Formation is absent, the Grande Ronde overlies older basement rocks. Spokane Falls is carved from this unit. Equivalent to unit ~~M~~v_{gN2} of Joseph (1990) and Waggoner (1990b).

Tl
Latah Formation (Miocene)--Lacustrine and fluvial deposits of gray to tan to yellow-orange siltstone, claystone, and minor sandstone that underlie and are interbedded with the Grande Ronde Basalt and Priest Rapids Member of the Wanapum Basalt in the Spokane area. The unit locally contains contains fossil leaves and carbonized logs. The Latah

Formation is more than 360 m thick at its deepest known point on the Peone Prairie (Derkey, 1997; Boleneus and Derkey, 1996). It also reaches a thickness of nearly 300 m below the base of the basalt in the Latah-Texas oil exploration well drilled near the mouth of Latah Creek. The formation is nearly 70 m thick below the lowest basalt in a well drilled at the Davenport Hotel in downtown Spokane. Equivalent to unit ~~M~~c$_l$ of Joseph (1990).

Intrusive Rocks

Td
Dikes (Eocene?)--Dikes of varied appearance and composition, most are light- to dark-gray and porphyritic. Dikes contain a diverse suite of phenocrysts including hornblende, biotite, plagioclase, quartz, potassium feldspar, and(or) pyroxene in a fine grained to aphanitic groundmass of feldspar, quartz, hornblende, and biotite. Rarely do more than three phenocryst types occur together. Equivalent to unit Ei of Waggoner (1990a) and to unit Eida of Joseph (1990).

Tt
Plutonic rocks near Tumtum (Eocene?)--Lineated and foliated, medium- to coarse-grained porphyritic biotite-hornblende monzodiorite to granodiorite (plutonic rock terminology after Streckheisen, 1974). Commonly heterogeneous in texture and grain size. Contains aligned euhedral hornblende prisms and pink and white potassium feldspar phenocrysts. Equivalent to unit Eigd$_t$ of Joseph (1990).

Tsp
Silver Point Quartz Monzonite (Eocene)--Leucocratic, coarse-grained porphyritic hornblende-biotite quartz monzonite. Characterized by euhedral hornblende and euhedral pink orthoclase in a bimodal groundmass. Quartz and potassium feldspar in the groundmass are consistently coarser grained than groundmass hornblende, biotite, and plagioclase. Contains honey-brown sphene visible to naked eye. Equivalent to unit Eiqm$_s$ of Joseph (1990) and to unit Eia$_s$ of Waggoner (1990a).

Tmr
Granite of Mount Rathdrum (Eocene?)--Massive to very weakly foliated, leucocratic, fine- to medium-grained, equigranular, muscovite-biotite quartz monzonite to granite that forms small plutons and dikes that sharply cut the foliation of older mylonitic rocks of Mount Spokane. Equivalent to unit Eiat$_r$ of Joseph (1990).

TKa
Alaskite, pegmatite, and aplite (Tertiary and Cretaceous)--Discontinuous sill- and dike-like bodies of alaskite, pegmatite, aplite, and fine- to coarse-grained quartz monzonite. Includes some muscovite-biotite quartz monzonite in the northernmost part of the County. The unit locally contains the uranium-bearing minerals autunite and meta-autunite as fracture coatings. 90,000 lbs of U_3O_8 were produced from nine properties, although most

of the ore came from the Daybreak Mine. Equivalent to unit TKiaa of Joseph (1990) and Waggoner (1990a).

TKu

Unassigned granitoids (Tertiary and Cretaceous)--Scattered bodies of undeformed, leucocratic, coarse-grained, equigranular to porphyritic, biotite granite, quartz monzonite, and granodiorite. In southern part of map area the rock is deeply weathered. Equivalent to unit TKia of Joseph (1990) and to unit TKiqm of Waggoner (1990b).

TKmc

Quartz monzonite and granite near Mud Creek (Tertiary and Cretaceous)--Leucocratic, coarse-grained, equigranular, biotite quartz monzonite to granite with minor muscovite. According to Joseph (1990, this unit is similar to and possibly a late-stage phase of the quartz monzonite near the Little Spokane River (Kls). Equivalent to unit $TKia_{mc}$ of Joseph (1990).

TKcc

Quartz monzonite of Corkscrew Canyon (Tertiary and Cretaceous)--Coarse-grained, equigranular to porphyritic, biotite quartz monzonite to granite. Joseph (1990) tentatively correlated this unit with the leucocratic intrusive rock of unit TKfm (see below) exposed south of the Spokane River. Equivalent to unit $TKia_c$ of Joseph (1990).

TKfm

Granite near Four Mound Prairie (Tertiary and Cretaceous)--Massive to weakly foliated, leucocratic, medium- to coarse-grained, equigranular, biotite granite to quartz monzonite. According to Joseph, this unit may be equivalent to the quartz monzonite of Corkscrew Canyon (TKcc). Equivalent to unit $TKia_f$ of Joseph (1990).

Kel

Monzogranite of Eloika Lake (Cretaceous?)--Homogeneous, leucocratic, medium- to coarse-grained muscovite-biotite monzogranite. Rock is faintly foliated and contains sillimanite. Equivalent to unit $Kiat_e$ of Waggoner (1990a).

Km

Quartz monzonite near the Midnite mine (Cretaceous)--Leucocratic, medium- to coarse-grained, locally porphyritic quartz monzonite to granite. The average U_3O_8 content of this intrusive body is 19 ppm; the range is from 1 to 46 ppm. Equivalent to unit Kia_m of Joseph (1990).

Kfl

Fan Lake Granodiorite (Cretaceous)--Leucocratic, medium- to coarse-grained hornblende-biotite granodiorite to monzogranite. Locally contains hornblende phenocrysts to 1 cm long and abundant sphene. Equivalent to unit $Kigd_f$ of Joseph (1990) and to unit Kia_f of Waggoner (1990a).

Kw
Granodiorite near Wellpinit (Cretaceous)--Leucocratic, massive, medium-grained, biotite-hornblende granodiorite. Equivalent to unit $Kigd_w$ of Joseph (1990).

Ko
Quartz monzonite near Otter Creek (Cretaceous)--Leucocratic, coarse-grained, equigranular, foliated, muscovite-biotite quartz monzonite to granite. Sillimanite partially replaces biotite and cataclastic textures are locally present. The granite is deeply weathered and cut by alaskite and pegmatite dikes. Equivalent to unit $Kiat_o$ of Joseph (1990) and to unit $Kiat_e$ of Waggoner (1990a).

Kmsg
Mount Spokane Granite (Cretaceous)--Leucocratic, foliated to massive, medium- to fine-grained biotite-muscovite granite to monzogranite. The unit is variably deformed, grading from homogeneous granite in the western parts of the unit, to deformed granite and mylonite, to mylonitic rocks of the Newman Lake Gneiss that may be deformed equivalents of the Mt. Spokane granite. Equivalent to unit $Kiat_s$ of Joseph (1990) and to unit $Kiat_{ms}$ of Waggoner (1990a).

Kls
Quartz monzonite near the Little Spokane River (Cretaceous)--Leucocratic, medium- to coarse-grained, foliated to massive, muscovite-biotite quartz monzonite to granite that is similar to the Mount Spokane granite. The body is intruded by dikes and small bodies of massive hornblende-biotite granodiorite and is cut by alaskite and muscovite-bearing pegmatite dikes that in places make up as much as 50 percent of the total outcrop, as in roadcuts along U.S. Highway 395 at the Little Spokane River. The dimension stone used in part of the downtown Spokane U.S. Post Office came from a quarry in this unit. Equivalent to unit $Kiat_{ls}$ of Joseph (1990).

Ksv
Granodiorite west of Spring Valley (Cretaceous)--Medium- to coarse-grained weakly to non-foliated muscovite-biotite granodiorite to monzogranite. Biotite constitutes $\leq$10 percent of most rock, and muscovite is sparse (Miller, 1974). Equivalent to unit $Kiat_s$ of Waggoner (1990a).

Kc
Monzogranite of the Camden area (Cretaceous)--Medium-grained biotite monzogranite to granodiorite composed of plagioclase, K-feldspar, quartz, abundant biotite, and sparse hornblende; magnetite, zircon, and apatite are the most abundant accessory minerals. The western part of the pluton has a cataclastic texture and is incipiently metamorphosed. The pluton is deeply weathered and poorly exposed. Equivalent to unit Kia_c of Waggoner (1990a).

Klr

Monzogranite of Little Roundtop (Cretaceous)--Deeply weathered equigranular biotite monzogranite characterized by its coarse grain size (average about 1 cm). Locally contains pink K-feldspar. Equivalent to unit Kig_l of Waggoner (1990a).

Paleozoic and Proterozoic Metasedimentary Rocks

ЄZa

Addy Quartzite, undivided (Lower Cambrian to Upper Proterozoic)--Mostly thick-bedded, vitreous white, light-gray, to pink, medium- to fine-grained quartzite, containing some siltite and argillite. Formerly mined for silica near Chewelah. Locally contains trilobite fossils in upper part. Equivalent to unit $ЄZq_a$ of Waggoner (1990a).

ЄYu

Metasedimentary rocks, undivided (Cambrian or Precambrian Y)-- Medium to thick bedded, fine-grained, muscovite-bearing quartzite to silty quartzite. Minor quartz-rich phyllite and muscovite schist. Equivalent to unit ЄYmm of Joseph (1990).

ЄYq

Quartzite near Edwall (Cambrian or Precambrian Y)--Medium- to thick-bedded, white to light-gray, fine-grained, vitreous quartzite. Interbedded with buff and light-green siltite. Equivalent to unit ЄYq of Joseph (1990).

<u>Deer Trail Group</u>

Ydq

Deer Trail Group, quartzite (Middle Proterozoic)--White to light-gray, medium- to thick-bedded quartzite. May correlate with Buffalo Hump Formation. Equivalent to unit Yq of Joseph (1990).

Ydb

Deer Trail Group, Buffalo Hump Formation (Middle Proterozoic)--White to light-gray, thick-bedded quartzite, pebbly quartzite, and medium- to dark-gray siltite. Equivalent to unit Yq_{bh} of Joseph (1990).

Ydm

Deer Trail Group, McHale Slate (Middle Proterozoic)--Medium- to dark-gray argillite with quartzite laminae. Equivalent to unit Ymm_m of Joseph (1990).

Belt Supergroup

Ybu

Belt Supergroup, undivided (Middle Proterozoic)-- Argillite and siltite. Includes Belt Supergroup formations too altered and bleached to assign formational names. Equivalent to unit Yms_{bu} of Waggoner (1990a).

Ysp

Missoula Group, Striped Peak Formation. (Middle Proterozoic)-- Consists chiefly of siltite with lesser amounts of argillite, quartzite, and dolomite. Includes unit A of Striped Peak Formation in Chewelah quadrangle. Equivalent to unit Yms_a of Waggoner (1990a) and to unit Yms_{sp} of Waggoner (1990b).

Yw

Wallace Formation, undivided (Middle Proterozoic)--Argillite, siltite, quartzite, and impure dolomite. Equivalent to unit Yms_w of Joseph (1990) and Waggoner (1990a).

Ywu

Wallace Formation, upper unit (Middle Proterozoic)--Dark gray to black laminated argillite, locally containing zones of tan dolomite. Equivalent to unit Yms_{wu} Waggoner (1990a, b).

Ywl

Wallace Formation, lower unit (Middle Proterozoic)--Pale tan quartzite, siltite, carbonate-bearing quartzite and siltite, and impure carbonate rock. Characterized by pinch-and swell bedding. Equivalent to unit Yms_{wl} Waggoner (1990a, b).

Yr

Ravalli Group, undivided (Middle Proterozoic)-- May include all Ravalli Group Formations (St. Regis, Revett, and Burke Formations) on Spokane quadrangle. Equivalent to unit Yms_r of Joseph (1990).

Ysr

Ravalli Group, St. Regis Formation (Middle Proterozoic)-- Interbedded siltite and argillite and subordinate quartzite. Characterized by interbedded maroon- and green-tinted strata. Equivalent to unit Yms_s (also identified as Yms_{sr} in the text) of Waggoner (1990a) and to unit Yms_{sr} of Waggoner (1990b).

Yrb

Ravalli Group, Revett and Burke Formations (Middle Proterozoic)-- on Rosalia quadrangle. Equivalent to unit Yms_{rb} of Waggoner (1990b). Subdivided on Chewelah quadrangle into:

Yrv
Ravalli Group, Revett Formation (Middle Proterozoic)-- White to light gray, fine grained, vitreous quartzite with lesser siltite and sparse argillite. Equivalent to unit Yms_r of Waggoner (1990a).

Yb
Ravalli Group, Burke Formation (Middle Proterozoic)-- Well-bedded gray siltite with lesser quartzite and argillite. Equivalent to unit Yms_{bf} of Waggoner (1990a).

High Grade Metamorphic Rocks

Knl
Newman Lake Gneiss (Cretaceous)--Medium- to dark-gray, medium- to coarse-grained, mylonitic, hornblende-biotite granodiorite gneiss. The unit is characterized by megacrysts of orthoclase as large as 2 cm long and contains plagioclase, K-feldspar, quartz, biotite, hornblende. The unit contains conspicuous foliation that dips gently southwest and a mineral lineation that plunges southwest. Equivalent to unit Kog_n of Joseph (1990) and Waggoner (1990a).

Kms
Deformed granite and banded mylonite gneiss of Mount Spokane (Cretaceous?)--In southern exposures, distinguished by muscovite megacrysts as much as 2.5 cm across. Granite is increasingly foliated and lineated towards the north. In the mylonite the granite is so intensely deformed that it is a foliated and lineated banded two-mica-feldspar-quartz gneiss. The gently west-dipping mylonitic foliation is defined by alignment of micas; mylonitic lineation is defined by orientation of sillimanite, streaks of mineral grains, and striations. The contact with the Newman Lake Gneiss (Knl) is gradational in most localities. Equivalent to unit Kog_{ms} of Waggoner (1990a).
Unit is subdivided south of 47°30’N into:

Kms1
Muscovite-megacryst-bearing granite of Mount Spokane (Cretaceous?)-- Foliated and lineated biotite-muscovite quartz monzonite and granite. Similar compositionally to Mt. Spokane Granite (Kmsg), but contains muscovite books as large as 2.5 cm. Unit occurs between Mt. Spokane Granite (Kmsg) and Newman Lake Gneiss (Knl). Equivalent to unit Kog_{sm} of Joseph (1990).

Kms2
Orthogneiss of Mount Spokane (Cretaceous?)--Coarse-grained, quartz-feldspar-biotite-muscovite orthogneiss that has distinctive coarse mylonitic banding of light minerals and dark biotite-rich layers. In part, this unit is equivalent to Kog_{ms} of Waggoner (1990a). Unit overlies and is in gradational contact with Newman Lake Gneiss (Knl). Equivalent to unit Kog_s of Joseph (1990).

p€a

Amphibolite (Precambrian)--Local pods and small bodies of amphibolite containing an assemblage of plagioclase ± hornblende, sphene, garnet, diopside, ilmenite, and quartz. Individual bodies are locally as thick as 28 m. Amphibolite bodies are mapped only in the Hauser Lake Gneiss (p€h), but amphibolite is also present in gneiss south of the Spokane River and in the heterogeneous metamorphic rocks (p€m) on Browns Mountain. Equivalent to unit p€am of Joseph (1990).

p€h

Hauser Lake Gneiss (Precambrian)--Rusty-weathering, medium-grained, well-banded, foliated and lineated mylonitic biotite-orthoclase-plagioclase-quartz metasedimentary gneiss and schist. Quartzite is locally present. Muscovite-biotite schist layers are less than 1 m thick and quartz-feldspar layers as thick as 3 m. Foliation and lineation generally are gently dipping to horizontal. The gneiss locally contains abundant pods and lenses of garnet-bearing amphibolite (p€a). Equivalent to unit p€bg_h of Joseph (1990) and Waggoner (1990a).

p€m

Heterogeneous metamorphic rocks (Precambrian)--Unit is composed of unassigned high-grade metamoprhic rocks that range from common metasedimentary quartz-feldspar-mica gneisses, schists, and quartzites, to locally-occurring sillimanite- or andalusite-bearing graphitic quartz-mica schist, amphibolite, migmatite, and orthogeniss. Equivalent to unit p€hm of Waggoner (1990a) and Joseph (1990).

p€f

Quartzite near Freeman (Precambrian)--Medium-grained, thin- to thick-bedded, white to gray quartzite. The base of the unit is a massive white quartzite, 5 to 35 m thick which grades upward into gray, thin- to medium-layered micaceous feldspathic quartzite. Equivalent to unit p€qz of Joseph (1990).

p€mp

Gneiss of Mica Peak (Precambrian)--Light-gray, coarse-grained muscovite-quartz-feldspar schist and segregation gneiss that consists of mica-rich layers separating quartz-feldspar pods, segregations, and layers. The schist commonly contains more than 50 percent mica and locally contains sillimanite and biotite. Concordant and discordant granitic bodies make up as much as 50 percent of the unit. Small scattered amphibolite bodies are present in the eastern part of the unit. The contact with the underlying gneiss near Round Mountain (p€rm) is gradational through 5 to 35 m. Equivalent to unit p€bg_m of Joseph (1990) and Waggoner (1990b).

p€rm

Gneiss near Round Mountain (Precambrian)--Light pinkish gray, medium- to fine-grained, quartz-feldspar-muscovite-sillimanite schist and gneiss. The gneiss is poorly layered and contains abundant small folds. It is intruded by sparse pegmatite and granitic dikes and minor small amphibolite bodies. Equivalent to unit p€sc_r of Joseph (1990).

pꞒc
Gneiss near Cable Peak (Precambrian)--Light- to dark-gray, chiefly medium-gray, prominently layered gneiss and schist. Individual layers are generally less than 15 cm thick and include quartzite, feldspathic quartzite, and micaceous quartz-feldspar gneiss, granitic gneiss, amphibolite, and schist. Equivalent to unit pꞒbg$_c$ of Joseph (1990).

pꞒrl
Schist near Rock Lake (Precambrian)-- fine to medium grained garnet-biotite-muscovite-quartz schist and subordinate micaceous quartzite. Equivalent to unit pꞒsc of Waggoner (1990b).

GIS Documentation

The digital geologic map of Spokane County and vicinity includes an arc attribute table, SPOKCO.AAT, that relates to the SPOKCO.CON, SPOKCO.STR, SPOKCO.LGU, and SPOKCO.REF look-up tables; a polygon attribute table, SPOKCO.PAT, that relates to the SPOKCO.RU and SPOKCO.REF look-up tables; and three point attribute tables, SPCOPNT1.PAT, SPCOPNT2.PAT, SPCOPNT3.PAT that relate to the SPCOPNT1.ALC, SPCOPNT2.ALC, SPCOPNT3.ALC look-up tables, respectively, and the SPOKCO.REF look-up (Fig. 4). These tables are described in the following pages.

Linear Features

Descriptions of the items identifying contacts, boundaries, structures, and linear geologic units in the arc attribute table, SPOKCO.AAT, are as follows:

SPOKCO.AAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code used to identify type of linear feature. Linecodes < 100 are used for contacts and boundaries which are described in the SPOKCO.CON file. Linecodes > 100 and < 600 represent structural features which are described in the SPOKCO.STR file. Linecodes > 800 represent linear geologic units which are described in the SPOKCO.LGU file.
name	character	30	Name given to structural feature. No faults were named on the source maps, thus this item does not contain any names.
source	integer	4	Numeric code used to identify the data source for the linear feature. Complete references for the sources are listed in the SPOKCO.REF file.

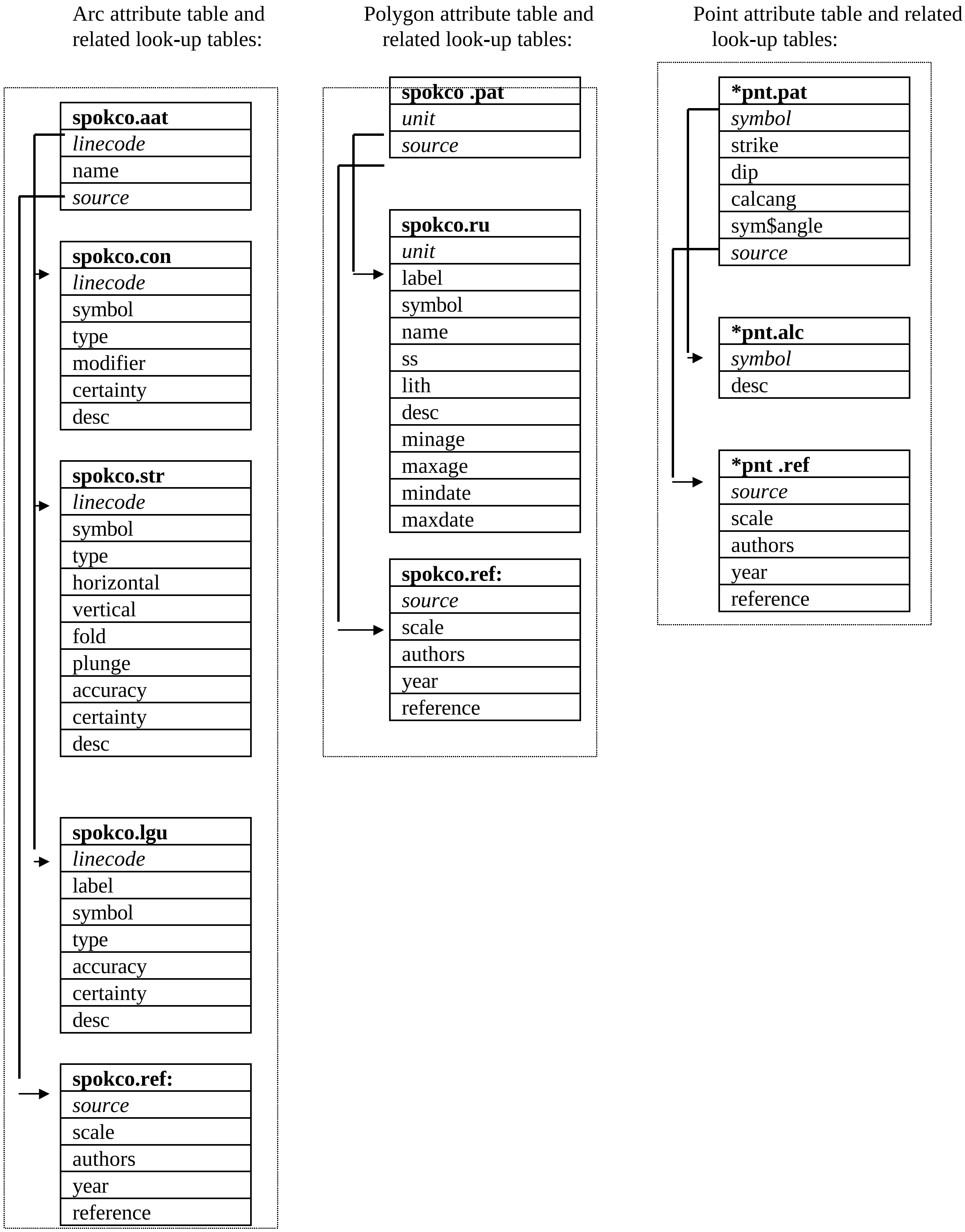

Figure 4: Relationships between feature attribute tables and look-up tables.

Attribute descriptions for items in the contacts and boundaries look-table, SPOKCO.CON, are as follows:

SPOKCO.CON			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value < 100) used to identify type of contact or boundary. (This item also occurs in SPOKCO.AAT.)
symbol	integer	3	Line symbol number used by Arc/Info to plot arc. Symbol numbers refer to PLOTTER.LIN lineset
type	character	10	Major type of line, i.e., contact, water, ice, outcrop, political, neat, limit.
modifier	character	20	Line type modifier, i.e., approximate, concealed, gradational. No entry implies 'known.'
certainty	character	15	Degree of line type certainty, i.e., inferred, uncertain. No entry implies 'certain.'
desc	character	100	Written description or explanation of contact or boundary.

Attribute descriptions for items in the structures look-up table, SPOKCO.STR, are as follows:

SPOKCO.STR			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value > 100 and < 600) used to identify type of structural feature. (This item also occurs in SPOKCO.AAT.)
symbol	integer	3	Line symbol number used by Arc/Info to plot arc. Symbol numbers refer to CARTO.LIN lineset
type	character	10	Major type of structure, i.e., fault, fracture, fold, other.
horizontal	character	20	Type of horizontal fault movement, i.e., strike-slip, left-lateral, right-lateral. No entry implies 'unknown.'
vertical	character	20	Type of vertical fault movement, i.e., normal, low-angle, reverse, thrust, detachment, vertical. No entry implies 'unknown.'
fold	character	15	Type of fold, i.e., anticline, syncline, monocline.
plunge	character	15	Type of plunge on fold, i.e., horizontal, plunging, plunging in, plunging out.
accuracy	character	15	Line type modifier indicating degree of accuracy, i.e., approximate, concealed, gradational. No entry implies 'known.'
certainty	character	15	Degree of line type certainty, i.e., inferred, uncertain. No entry implies 'certain.'
desc	character	100	Written description or explanation of structural feature

Attribute descriptions for items in the linear geologic units look-up table, SPOKCO.LGU, are as follows:

SPOKCO.LGU			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
linecode	integer	3	Numeric code (a value > 800) used to identify type of linear geologic unit. (This item also occurs in SPOKCO.AAT.)
label	character	10	Map label used in the map proper to identify map unit.
symbol	integer	3	Line symbol number used by Arc/Info to plot linear geologic unit. Symbol numbers refer to CARTO.LIN lineset.
type	character	10	Major type of linear geologic unit, i.e., dike, vein, or other.
accuracy	character	15	Line type modifier indicating degree of accuracy, i.e., approximate, concealed, gradational. No entry implies ‘known.’
certainty	character	15	Degree of line type certainty, i.e., inferred, uncertain. No entry implies ‘certain.’
desc	character	60	Written description or explanation of linear geologic unit

Areal Features

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

SPOKCO.PAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
unit	integer	4	Numeric code used to identify the rock unit which is described in the SPOKCO.RU look-up table. (This item also occurs in SPOKCO.RU.)
source	integer	4	Numeric code used to identify the data source for the rock unit. Complete references for the sources are listed in the SPOKCO.REF file.

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

SPOKCO.RU			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
unit	integer	4	Numeric code used to identify the rock unit. (This item also occurs in SPOKCO.PAT.)
label	character	10	Rock unit label (abbreviation) used to label unit on map.
symbol	integer	3	Shadeset symbol number used by Arc/Info to plot a filled/shaded polygon. Symbol numbers refer to the CALCOMP1.SHD shadeset.
name	character	7	The prefix portion of the geologic unit label that does not include subscripts. (If subscripting is not used in the original source map label, then the 'name' entry is the same as the 'label' entry.)
ss	character	3	The suffix portion of the rock unit label that includes subscripts.
lith	character	20	Major type of lithology, i.e., unconsolidated sediment, sedimentary, metasedimentary, intrusive, extrusive, metamorphic, water, ice.
desc	character	100	Formal or informal unit name
minage	character	7	Minimum stratigraphic age of lithologic unit, i.e., CRET, TERT, PCY
maxage	character	7	Maximum stratigraphic age of lithologic unit
mindate	integer	4	Minimum radiometric age (in millions of years) if an age date was performed.
maxdate	integer	4	Maximum radiometric age (in millions of years) if an age date was performed.

Point Features

Descriptions of the items identifying geologic structural map symbols are given in the point attribute tables, SPCOPNT1.PAT, SPCOPNT2.PAT, and SPCOPNT3.PAT which are defined as follows:

SPCOPNT1. PAT, SPCOPNT2. PAT, and SPCOPNT3.PAT			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
symbol	integer	3	Marker symbol number used by Arc/Info to identify type of geologic map symbol. Symbol numbers refer to the ALCGEOL.MRK markerset (Fitzgibbon and Wentworth, 1991). (This item also occurs in the *.ALC files)
strike	integer	3	Strike of bedding or foliation, bearing of lineation, or sample number. Strike and bearing are azimuthal angles (measured in degrees from 0 to 360 in a clockwise direction from North). Sample number may refer to a rock sample used for geochemical analysis or radiometric age dating.
dip	integer	3	Dip of bedding or foliation. 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.
plunge	integer	3	Plunge of lineation. This value is an angle measured (in degrees from 0 to 90) down from the horizontal, thus a horizontal plunge is 0 degrees and a vertical plunge is 0 degrees.
calcang	integer	3	An interim value used to calculate alc$angle. calcang = strike - 270.
alc$angle	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 symbol.
source	integer	4	Numeric code used to identify the data source for the structural map symbol. Complete references for the sources are listed in the *.REF files.

Attribute descriptions for items in the geologic map symbols look-up tables, SPCOPNT1. ALC, SPCOPNT2.ALC, and SPCOPNT3.ALC are as follows:

SPCOPNT*.ALC			
ITEM NAME	ITEM TYPE	ITEM LENGTH	ATTRIBUTE DESCRIPTION
symbol	integer	3	Marker symbol number used by Arc/Info to identify type of structural map symbol. Symbol numbers refer to the ALCGEOL.MRK markerset (Fitzgibbon and Wentworth, 1991). (This item also occurs in the SPCOPNT*.PAT files.)
desc	character	250	Written description or explanation of map symbol.

Source Attributes

Descriptive source or reference information for the SPOKCO and SPCOPNT* Arc/Info coverage files is stored in the SPOKCO.REF and SPCOPNT*.REF look-up files, respectively. Attribute descriptions for items in the *.REF data source files are as follows:

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

Obtaining Digital Data

The complete digital version of the geologic map is available in 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 northing):	-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/of98-503**
or
2. Anonymous FTP from **wrgis.wr.usgs.gov,** in the directory
pub/open-file/of98-503
The Internet sites contain the digital geologic map of Spokane County and vicinity both in Arc/Info EXPORT-format files (spokco.e00 and spokcopnt.e00) and as an HPGL2 plot file (spokco.hp) of the map area, 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 map, **spokco.hp,** from the USGS public access World Wide Web site on the Internet using the **URL = http://wrgis.wr.usgs.gov/open-file/of98-503**
or
2. Anonymous FTP the plot file, **spokco.hp,** from: **wrgis.wr.usgs.gov,** in the directory: **pub/open-file/of98-503**
3. This file can be plotted by any large-format color plotter that can interpret HPGL2. The finished plot is about 36 by 53 inches.

Paper copies of the map can also be created by obtaining one of the versions of the digital files as described above (in 'Obtaining Digital Data'), and then creating a plot file in a GIS.

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Appendix A - List of digital files in the Spokane County GIS

--Use the ‘00import.aml’ to IMPORT all of the *.E00 files for use in Arc/Info.
--Use the Arc/Info ‘DRAW’ command to plot the *.GRA file to your screen. (Make sure the display is set with the Arc/Info ‘DISPLAY’ command.)
--Use the Arc/Info ‘ROTATEPLOT’ command to rotate the *.GRA file, so as to be able

--Use the Arc/Info ‘HPGL2’ command to create a HPGL2 file from the rotated *.GRA file.
--Use the UNIX ‘lpr -P<plotter_name> spokcorot.hp’ command to send the spokcorot.hp file to a large-format color plotter that can interpret Hewlett-Packard Graphics Language.
--To re-create the *.GRA file, open the ArcPlot module, enter ‘display 1040’, enter a new filename for the graphics file, enter ‘&run spokco.’

Primary Arc/Info EXPORT-format files (pnf*.e00) for the digital geology:

- spokco.e00
- spcopnt1.e00
- spcopnt2.e00
- spcopnt3.e00

Arc/Info graphics (*.gra) and HPGL2 map plot (*.hp) files for the geologic map plate:

- spokco.gra
- spokcorot.hp

Additional Arc/Info EXPORT-format files (*.e00) necessary to re-create the geologic map plates:

- alcgeol.mrk.e00 markerset
- calcomp1.shd.e00 - shadeset
- county1.e00 - Spokane County boundary
- fnt038.e00 - font 38
- fnt040.e00 - font 40
- geology.mrk.e00 - markerset
- geology2.shd.e00 - shadeset
- spcoclip.e00 - exterior boundary of the mapped area
- spconet.e00 - latitude and longitude neatline hatch marks

AML, graphics, key, symbolset and text files necessary to re-create the geologic map plate:

- scale2a.aml - plots scale bar on plate
- spokco.aml - program that creates a graphics file of Spokane County and vicinity, Washington and Idaho.
- indexspc.gra - graphics file of index map showing location of map area.
- spcolin.key - lineset symbol values and descriptive text for lines on the map plate
- spc_pol1.key - shadeset symbol values and descriptive text for geologic map units on the map plate
- spc_pol2.key - shadeset symbol values and descriptive text for geologic map units on the map plate
- spcosym.key - markerset symbol values and descriptive text for map symbols (markers) on the map plate
- spokco.crd - text file listing map credits on the map plate
- spokco.ref - text file listing map references on the map plate
- spcdisc.txt - text file with map disclaimer

Appendix B - Arc/Info Macro Language program (spokco.aml) used to plot the geologic map of Spokane County and vicinity

```
/* spokco.aml, 9/24/98, pd
/* ***********************
/* This Arc/Info Macro Language
(AML) program will plot the geologic
map plate for Spokane County and
vicinity.

/* To run this AML:
/*     1. Type 'ap' at the 'Arc:' prompt to
enter the ArcPlot module,
/*     2. Type 'display 1040' at the
'Arcplot:' prompt to create a GRA file,
/*     3. Enter a filename of your own
choosing at the 'Enter ARC/INFO
Graphics filename :' prompt for the GRA
to be created,
/*     4. Type '&run spokco' at the
'ArcPlot:' prompt to start the program,
/*     5. Run the Arc/Info
'ROTATEPLOT' command to rotate the
plot 90 degrees for plotting out, i.e.,
rotateplot spokco spokcorot
/*     6. Run the Arc/Info 'HPGL2'
command to convert the GRA file to an
HPGL2 file, i.e., hpgl2 spokcorot
spokcorot.hp # 1.0 opaque # 0 # # #
cal.dat
/*     6. Execute the UNIX 'lpr' command
to print the 1:100,000-scale geologic
map plot on your plotter, i.e., lpr -
Ppicasso spokcorot.hp
/* ************************
/*For creating PostScript files (for
PDFs):
/*        Arcplot: disp 1040 2
/*        Enter Adobe PostScript filename
: plate1
/*        Arcplot: &r spokco
/*        Arcplot: q
/*        Arc: ls -l *ps
/* ************************

clear
clearselect

mape spokco
pagesize 35.5 53.0
mappos ll 1.0 7.0
mapunits meters
mapscale 100000
mapangle 0.36
textquality proportional
textfont 94021
linedelete all
lineset plotter
lineset carto
&s disclaimer spcdisc.txt

/* cut marks
markerset plotter
markersymbol 1
markersize 0.1
marker 0 0
marker 0 53.0
marker 35.5 0
marker 35.5 53.0

/* plot geology and label units
shadeset calcomp1
polygonshade spokco unit spokco.ru
shadedelete all
shadeset geology2
res spokco poly unit = 155 or unit = 156
polygonshade spokco unit spokco.ru2
asel spokco poly
res spokco arcs linecode lt 100 and
linecode gt 0
arclines spokco linecode spokco.con
asel spokco arcs
res spokco arcs linecode lt 800 and
linecode gt 100
arclines spokco linecode spokco.str
```

```
asel spokco arcs
res spokco arcs linecode gt 800
arclines spokco linecode spokco.lgu
asel spokco arcs
res spokco poly area gt 300000
textsize 0.10
labeltext spokco unit spokco.ru cc
asel spokco poly
res spokco poly unit = 114
labeltext spokco unit spokco.ru cc
asel spokco poly

&label points
/*  plot points for Rosalia, Spokane and Chewelah quads
markerdelete all
markerset alcgeol.mrk
pointmarkers spcopnt2 pttype spcopnt2.alc
pointmarkers spcopnt1 symbol
pointmarkers spcopnt3 symbol
/*  plot annotation for all points
textset font.txt
annotext spcopnt2 all
annotext spcopnt1 all
/* annotext cover subclass # {level...level}
annotext spcopnt3 dip # 1 2

/* plot Spokane County boundary
arclines county1 127
asel county1 arc

&label titles
textfont 93715
textquality kern
textsize 0.5
move 1.0 51.8
text 'U.S. DEPARTMENT OF THE INTERIOR'
move 1.0 51.1
text 'U.S. GEOLOGICAL SURVEY'
move 34.5 51.8
text 'Open-File Report 98-503' lr
move 19 51.8
text 'Prepared in cooperation with the' lc
move 19 51.1
text 'WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES and' lc
move 19 50.4
text 'the SPOKANE COUNTY DIVISION OF PUBLIC WORKS, UTILITIES DEPARTMENT' lc
textsize 0.5
move 18.0 2.2
text 'Digital Geologic Map of Spokane County and Vicinity, Washington and Idaho' lc
textsize 0.4
move 18.0 1.4
text 'compiled by Bruce R. Johnson, Pamela D. Derkey, Thomas P. Frost, Robert E. Derkey and Beatrice B. Lackaff' lc
move 18.0 0.6
text '1998' lc

/* plot explanation/key
textfont 93711
textsize 0.25
move 3.5 8.3
text 'Explanation'
textsize 0.12
textquality proportional
textfont 94021
linesymbol 1
shadedelete all
shadeset calcomp1
keyarea 3.5 3.5 35.5 8.0
keybox 0.4 0.3
keyseparation 0.2 0.2
keyshade spc_pol1.key
shadedelete all
shadeset geology2
keyarea 3.5 3.5 35.5 8.0
keyshade spc_pol2.key nobox
keyarea 23.8 3.5 35.5 8.0
keybox 0.4 0.0
keyline spcolin.key nobox
markerdelete all
```

```
markerset alcgeol.mrk
keymarker spcosym.key nobox

/* plot references
textfont 93711
textsize 0.25
move 29.4 8.0
text 'References'
move 29.4 7.80
textfont 94021
textsize 0.12
textfile spokco.ref

/* plot credits
move 29.4 9.0
textfile spokco.crd

/* plot projection
move 3.5 9.0
text 'map projection: UTM, zone 11'

/* plot scale bar
&r scale2a 5.0 2.6 other 100000

&label index-map
plot indexspc.gra box 29.6 2.10 32.6
4.10
textfont 93713
textquality proportional
textsize 0.12
move 29.6 2.00
text 'Index map showing location of
mapped area'

&label disclaimer
textfont 93713
textquality proportional
textsize 0.12
move 29.4 1.60
textfile %disclaimer%

/* plot map outline
arclines spcoclip 103

/* plot lat/long tics
arcs spconet

/* label corners and lat/long tics
textfont 93709
textquality proportional
textsize 0.10
textangle 0

/* NW corner
move 3.23 45.77
text '118ø W' lc
move 3.14 45.70
text '48ø N' ur

/* N margin long.
move 10.58 45.73
text '117ø 45" W' lc
move 17.92 49.37
text '117ø 30" W' lc
move 25.25 49.37
text '117ø 15" W' lc

/* N-central corner lat/long.
move 16.08 49.34
text '117ø 37" 30"" W' lc
move 16.01 49.30
text '48ø 05" N' ur

/* NE corner
move 32.59 49.41
text '117ø W' lc
move 32.68 49.33
text '48ø 05" N' ul

/* E margin
move 32.72 45.69
text '48ø N' cl
move 32.77 40.21
text '48ø 52" 30"" N' cl
move 32.79 34.73
text '47ø 45" N' cl
move 32.84 29.26
text '47ø 37" 30"" N' cl
move 32.89 23.80
text '47ø 30" N' cl
```

```
move 32.9 18.33
text '47ø 22" 30"" N' cl
move 32.92 12.85
text '47ø 15" N' cl

/* SE corner
move 32.84 9.15
text '117ø W' uc
move 32.92 9.19
text '47ø 10" N' ll

/* S margin
move 10.48 9.1
text '117ø 45" W' uc
move 17.93 9.1
text '117ø 30" W' uc
move 25.37 9.1
text '117ø 15" W' uc

/* SW corner
move 2.96 9.17
text '118ø W' uc
move 2.92 9.19
text '47ø 10" N' lr

/* W margin lat.
move 3.09 40.21
text '47ø 52" 30"" N' cr
move 3.04 34.75
text '47ø 45" N' cr
move 3.04 29.29
text '47ø 37" 30"" N' cr
move 3.0 23.82
text '47ø 30" N' cr
move 2.94 18.34
text '47ø 22" 30"" N' cr
move 2.92 12.88
text '47ø 15" N' cr

&label done
quit
display 9999 3
draw spokco
&return
```

Appendix C - Metadata file (spokco.met) for the Spokane County and vicinity GIS

Identification_Information:
  Citation:
    Citation_Information:
      Originator: Bruce R. Johnson
      Originator: Pamela D. Derkey
      Originator: Thomas P. Frost
      Originator: Robert E. Derkey
      Originator: Beatrice B. Lackaff
      Publication_Date: 1998
      Title:
        Digital geologic map of Spokane County and vicinity, Washington
        and Idaho
      Edition: version 1.0
      Geospatial_Data_Presentation_Form: map
      Series_Information:
        Series_Name: Open-File Report 98-503
        Issue_Identification: spokco
        Issue_Identification: spcopnt1
        Issue_Identification: spcopnt2
        Issue_Identification: spcopnt3
      Publication_Information:
        Publication_Place: Spokane WA
        Publisher: U.S. Geological Survey

      Online_Linkage: URL = http://wrgis.wr.usgs.gov/open-file/of98-503
  Description:
    Abstract:
      The geology of Spokane County and vicinity, Washington and Idaho was compiled from Carrara and others (1995), Joseph (1990), Kiver and others (1979), Miller (written communication, 1995), and Waggoner (1990a, b) for input into an Arc/Info geographic information system (GIS). The digital geologic map database can be queried in many ways to produce a variety of derivative geologic maps.

    Purpose:
      This dataset was developed to provide a geologic map GIS of Spokane County for use in future spatial analysis by a variety of users.
      These data will better enable Spokane County agencies to predict the likely occurrence of additional mineral lands, primarily containing sand, gravel, rock and clay deposits.

      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).

Supplemental_Information:
This GIS consists of four major Arc/Info datasets: one line and polygon file (spokco) containing geologic contacts and structures (lines) and geologic map rock units (polygons), and three point files (spcopnt1, spcopnt2, and spcopnt3) containing structural point data.

Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1998
Currentness_Reference: publication date

Status:
Progress: In progress
Maintenance_and_Update_Frequency:
Will update with new geologic map data model, perhaps in 1999.

Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -118.0
East_Bounding_Coordinate: -117.0
North_Bounding_Coordinate: 48.125
South_Bounding_Coordinate: 47.125

Keywords:
Theme:
Theme_Keyword_Thesaurus: none
Theme_Keyword: geology
Theme_Keyword: geologic map
Place:
Place_Keyword_Thesaurus: none
Place_Keyword: Washington
Place_Keyword: Idaho
Place_Keyword: Spokane
Place_Keyword: Spokane County
Place_Keyword: Pacific Northwest
Place_Keyword: USA

Access_Constraints:

Use_Constraints:
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 1:24,00).

Any hardcopies utilizing these data sets shall clearly indicate their source. If the user has modified the data in any way they are obligated to describe the types of modifications they have performed on the hardcopy map. User specifically agrees not to misrepresent these data sets, nor to imply that changes they made were approved by the U.S. Geological Survey.

Point_of_Contact:
  Contact_Information:
    Contact_Person_Primary:
      Contact_Person: Pamela D. Derkey
      Contact_Organization: U.S. Geological Survey
    Contact_Position: geologist
    Contact_Address:
      Address_Type: mailing and physical address
      Address: 904 W. Riverside Ave., Rm. 202
      City: Spokane
      State_or_Province: WA
      Postal_Code: 99201
      Country: USA
    Contact_Voice_Telephone: 1-509-353-3173
    Contact_Facsimile_Telephone: 1-509-353-0505
    Contact_Electronic_Mail_Address: pderkey@usgs.gov

Data_Set_Credit:

Native_Data_Set_Environment:
  SunOS, 5.5.1, sun4u UNIX
  ARC/INFO version 7.1.1

Data_Quality_Information:
  Attribute_Accuracy:
    Attribute_Accuracy_Report:
      Attribute accuracy was verified by manual comparison of the source with hard copy printouts and plots.

  Logical_Consistency_Report:
    Polygon and chain-node topology present.
    Polygons intersecting the neatline are closed along the border.
    Segments making up the outer and inner boundaries of a poygon tie end-to-end to completely enclose the area. Line segments are a set of sequentially numbered coordinate pairs. No duplicate features exist nor duplicate points in a data string. Intersecting

lines are separated into individual line segments at the point of intersection. Point data are represented by two sets of coordinate pairs, each with the same coordinate values. All nodes are represented by a single coordinate pair which indicates the beginning or end of a line segment. The neatline was generated by mathematically generating the four sides of the quadrangle, densifying the lines of latitude and projecting the file to UTM zone 11 (with a y-shift).

Completeness_Report:
This dataset was produced from previously published reports (Carrara and others, 1995; Derkey and others, 1998; Johnson and Derkey, 1998; Joseph, 1990; Kiver and others, 1979; and Waggoner, 1990a, b) and from unpublished field mapping by Miller (written communication, 1995). These sources are considered to be the best geologic maps available for the area at a scale of 1:100,000.

Positional_Accuracy:
  Horizontal_Positional_Accuracy:
    Horizontal_Positional_Accuracy_Report:
      The horizontal positional accuracy for the digital data is probably no better than +/- 70 meters.
      It was tested by visual comparison of the source with hard copy plots.

Lineage:
  Source_Information:
    Source_Citation:
      Citation_Information:
        Originator: Carrara, P.E.
        Originator: Kiver, E.P.
        Originator: Stradling, D.F.
        Publication_Date: 1995
        Title:
          Surficial geologic map of the Chewelah 30- x 60-minute quadrangle, Washington and Idaho
        Geospatial_Data_Presentation_Form: map
        Series_Information:
          Series_Name: Miscellaneous Investigations Series
          Issue_Identification: Map I-2472
        Publication_Information:
          Publisher: U.S. Geological Survey
    Source_Scale_Denominator: 100,000
    Type_of_Source_Media: paper map

Source_Time_Period_of_Content:
  Time_Period_Information:
    Single_Date/Time:
      Calendar_Date: 1995
  Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: Carrara and others, 1995
Source_Contribution: This map was used in the map compilation.
Source_Information:
  Source_Citation:
    Citation_Information:
      Originator: Derkey, P.D.
      Originator: Johnson, B.R.
      Originator: Lackaff, B.B.
      Originator: Derkey, R.D.
      Publication_Date: 1998
      Title:
        Digital geologic map of the Rosalia 1:100,000 quadrangle,
        Washington and Idaho: a digital database for the 1990 S.Z.
        Waggoner map
      Geospatial_Data_Presentation_Form: map
      Series_Information:
        Issue_Identification: Open-File Report 98-357
      Publication_Information:
        Publisher: U.S. Geological Survey
      Online_Linkage: URL = http://wrgis.wr.usgs.gov/open-file/of98-357
  Source_Scale_Denominator: 100,000
  Type_of_Source_Media:
    digital GIS served by the USGS on the World Wide
    Web
  Source_Time_Period_of_Content:
    Time_Period_Information:
      Single_Date/Time:
        Calendar_Date: 1998
    Source_Currentness_Reference: publication date
  Source_Citation_Abbreviation: Derkey and others, 1998
  Source_Contribution:
    These digital files were used in the digital map
    compilation.
Source_Information:
  Source_Citation:
    Citation_Information:
      Originator: Johnson, B.R.
      Originator: Derkey, P.D.
      Publication_Date: 1998
      Title:

Digital geologic map of the Spokane 1:100,000 quadrangle,
Washington and Idaho: a digital database for the 1990 N.L.
Joseph map
Geospatial_Data_Presentation_Form: map
Series_Information:
Issue_Identification: Open-File Report 98-115
Publication_Information:
Publisher: U.S. Geological Survey
Online_Linkage:
URL = http://wrgis.wr.usgs.gov/docs/northwest_region~
/ofr98-115.html
Source_Scale_Denominator: 100,000
Type_of_Source_Media:
digital GIS served by the USGS on the World Wide
Web
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1998
Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: Johnson and Derkey, 1998
Source_Contribution:
These digital files were used in the digital map
compilation.
Source_Information:
Source_Citation:
Citation_Information:
Originator: Joseph, N.L.
Publication_Date: 1990
Title:
Geologic map of the Spokane 1:100,000 quadrangle,
Washington and Idaho
Geospatial_Data_Presentation_Form: map
Series_Information:
Issue_Identification: Open File Report 90-17
Publication_Information:
Publication_Place: Olympia, WA
Publisher: Washington Division of Geology and Earth Resources
Source_Scale_Denominator: 100,000
Type_of_Source_Media: stable-base mylar
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1990
Source_Currentness_Reference: publication date

Source_Citation_Abbreviation: Joseph, 1990
Source_Contribution:
This map was used by Johnson and Derkey (1998) to create a
digital geologic map of the Spokane quadrangle.
Source_Information:
Source_Citation:
Citation_Information:
Originator: Kiver, E.P.
Originator: Rigby, J.C.
Originator: Stradling, D.F.
Publication_Date: 1979
Title: Surficial geologic map of the Spokane quadrangle, Washington
Geospatial_Data_Presentation_Form: map
Series_Information:
Issue_Identification: Open File Report 79-11
Publication_Information:
Publisher: Washington Division of Geology and Earth Resources
Source_Scale_Denominator: 100,000
Type_of_Source_Media: paper map
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1979
Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: Kiver and others, 1979
Source_Contribution: This map was used in the map compilation.
Source_Information:
Source_Citation:
Citation_Information:
Originator: Miller, F.K.
Publication_Date: unpublished material
Title:
Geologic map of the Chewelah 30- by 60-minute quadrangle,
Washington and Idaho
Geospatial_Data_Presentation_Form: map
Source_Scale_Denominator: 100,000
Type_of_Source_Media: stable-base greenline mylar
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1995
Source_Currentness_Reference: date of written communication
Source_Citation_Abbreviation: Miller, written communication, 1995
Source_Contribution:
This unpublished map was used in the map

```
        compilation.
    Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: U.S. Geological Survey
          Publication_Date: 1993
          Title:
            1:100,000-scale digital line graph (DLG) data -
            hydrography and transportation, Area 13 --
            Northwestern states
          Geospatial_Data_Presentation_Form: digital line graph (DLG) data
          Series_Information:
            Series_Name: US GeoData (optional format)
          Publication_Information:
            Publisher: U.S. Geological Survey
      Source_Scale_Denominator: 100,000
      Type_of_Source_Media: CD-ROM
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: 1993
        Source_Currentness_Reference: publication date
      Source_Citation_Abbreviation: USGS, 1993
      Source_Contribution:
        This source provided digital hydrography.
  Source_Information:
      Source_Citation:
        Citation_Information:
          Originator: Waggoner, S.Z.
          Publication_Date: 1990
          Title:
            Geologic map of the Chewelah 1:100,000 quadrangle,
            Washington-Idaho
          Geospatial_Data_Presentation_Form: map
          Series_Information:
            Issue_Identification: Open-File Report 90-14
          Publication_Information:
            Publication_Place: Olympia, WA
            Publisher: Washington Division of Geology and Earth Resources
      Source_Scale_Denominator: 100,000
      Type_of_Source_Media: stable-base mylar
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Single_Date/Time:
            Calendar_Date: 1990
```

Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: Waggoner, 1990a
Source_Contribution: This map was used in the map compilation.
Source_Information:
Source_Citation:
Citation_Information:
Originator: Waggoner, S.Z.
Publication_Date: 1990
Title:
Geologic map of the Rosalia 1:100,000 quadrangle,
Washington-Idaho
Geospatial_Data_Presentation_Form: map
Series_Information:
Issue_Identification: Open File Report 90-7
Publication_Information:
Publication_Place: Olympia, WA
Publisher: Washington Division of Geology and Earth Resources
Source_Scale_Denominator: 100000
Type_of_Source_Media: stable-base material
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1990
Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: Waggoner, 1990b
Source_Contribution:
This map was used by Derkey and others (1998) to create a
digital geologic map of the Rosalia quadrangle.
Process_Step:
Process_Description:
The digital geologic maps of the Spokane and Rosalia quadrangles (Johnson and Derkey, 1998 and Derkey and others, 1998) were edgematched in Arc/Info GIS. Linework for the Chewelah quadrangle was digitized from Miller (written communication, 1995), Carrara and others (1995) and Waggoner (1990a) and edgematched to the Spokane-Rosalia map. T.P. Frost and R.E. Derkey resolved mis-matches across the Chewelah-Spokane quadrangle boundary by checking the contacts in the field. Structural point data for the Chewelah quadrangle was digitized from Miller (written communication, 1995).

Process_Date: 1995-1997

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: 1598
SDTS_Point_and_Vector_Object_Type: String
Point_and_Vector_Object_Count: 4430
SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
Point_and_Vector_Object_Count: 1599

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: implied
Longitude_of_Central_Meridian: implied
Latitude_of_Projection_Origin: implied
False_Easting: 0.000
False_Northing: -5,000,000 meters
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: not determined
Ordinate_Resolution: not determined
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:
The 'Digital geologic map of Spokane County and vicinity, Washington and Idaho' Open-File Report 98-503 contains a detailed description of each attribute code and a reference to the associated map symbols on the map source materials. The GIS includes a geologic linework arc attribute table, spokco.aat, that relates to the spokco.con (contact look-up table), spokco.str (structure look-up table), spokco.lgu (linear geologic unit look-up table) and spokco.ref (source reference look-up table) files; a rock unit polygon

attribute table, spokco.pat, that relates to the spokco.ru (rock unit look-up table) and spokco.ref (source reference look-up table) files; and three geologic map symbol point attribute tables, spcopnt1.pat, spcopnt2.pat, and spcopnt3.pat, that relate to the *pnt*.alc (structural point data look-up tables) and *pnt*.ref (source reference look-up table) files for each of the 1:100,000 quadrangles used in the Spokane County digital compilation.
Entity_and_Attribute_Detail_Citation: none

Distribution_Information:
Distributor:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: U.S. Geological Survey Information Services
Contact_Address:
Address_Type: mailing and physical address
Address: Open-File Reports, Box 25286
City: Denver
State_or_Province: CO
Postal_Code: 80225
Country: USA
Contact_Voice_Telephone: 1-303-202-4200
Contact_Facsimile_Telephone: 1-303-202-4695

Contact_Information:
Contact_Person_Primary:
Contact_Person: Pamela D. Derkey
Contact_Organization: U.S. Geological Survey
Contact_Position: Database Administrator
Contact_Address:
Address_Type: mailing and physical address
Address: 904 West Riverside, Rm. 202
City: Spokane
State_or_Province: WA
Postal_Code: 99201
Country: USA
Contact_Voice_Telephone: 1-509-353-3173
Contact_Facsimile_Telephone: 1-509-353-0505
Contact_Electronic_Mail_Address: pderkey@usgs.gov
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:
U.S. Geological Survey - Earth Science Information Office

Contact_Address:
Address_Type: mailing and physical address
Address: 904 West Riverside, Rm. 135
City: Spokane
State_or_Province: WA
Postal_Code: 99201
Country: USA
Contact_Voice_Telephone: 1-509-353-2524
Contact_Facsimile_Telephone: 1-509-353-2872
Contact_Electronic_Mail_Address: esnfic@mailmcan1.wr.usgs.gov
Hours_of_Service: 8:00 a.m. - 4:30 p.m., Pacific time zone
Distribution_Liability:
The U.S. Geological Survey (USGS) provides these geographic data "as is." The USGS makes no guarantee or warranty concerning the accuracy of information contained in the geographic data. The USGS further makes no warranties, either expressed or implied as to any other matter whatsoever, including, without limitation, the condition of the product, or its fitness for any particular purpose. The burden for determining fitness for use lies entirely with the user. Although these data have been processed successfully on computers at the USGS, no warranty, expressed or implied, is made by the USGS regarding the use of these data on any other system, nor does the fact of distribution constitute or imply any such warranty.

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

This digital geologic map GIS of Spokane County and vicinity, Washington adn Idaho, 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).

Metadata_Reference_Information:
Metadata_Date: 19980722
Metadata_Review_Date:
Metadata_Future_Review_Date:
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: U.S. Geological Survey
Contact_Person: Pamela D. Derkey
Contact_Position: geologist
Contact_Address:
Address_Type: mailing and physical address

Address: 904 West Riverside Avenue, Rm. 202
City: Spokane
State_or_Province: WA
Postal_Code: 99201
Country: USA
Contact_Voice_Telephone: 1-509-353-3173
Contact_Facsimile_Telephone: 1-509-353-0505
Contact_Electronic_Mail_Address: pderkey@usgs.gov
Metadata_Standard_Name:
FGDC Content Standards for Digital Geospatial
Metadata
Metadata_Standard_Version: Version of June 8, 1994
Metadata_Access_Constraints: none
Metadata_Use_Constraints: none