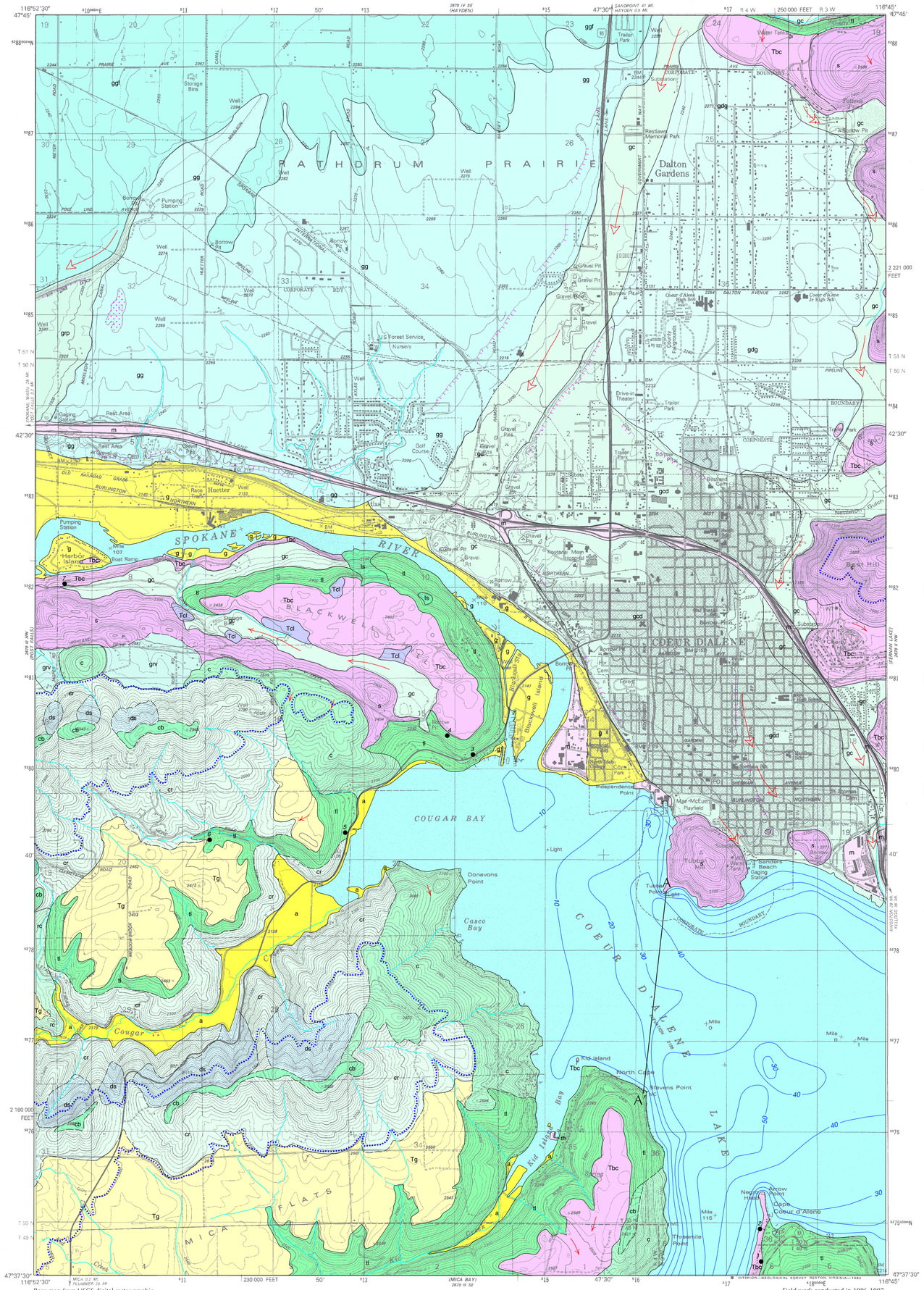
Surficial Geologic Map of the Coeur D'Alene Quadrangle, Kootenai County, Idaho

Roy M. Breckenridge and Kurt L. Othberg

1999



Base map from USGS digital raster graphic.

Topography by photogrammetric methods from aerial photographs taken 1975. Field checked 1977. Map edited 1981.

Projection and 10,000-foot grid ticks: Idaho coordinate system, west zone (transverse Mercator).

1000-meter Universal Transverse Mercator grid, zone 11, 1927 North American Datum.

UTM Grid and 1971 Magnetic North Declination at Center of Map

SCALE 1:24,000

1 1/2 0 1 MILE

1 0.5 0 1 KILOMETER

Contour Interval 40 Feet
Dotted Lines Represent 20-Foot Contours

Quadrangle Location

Field work conducted in 1996-1997.

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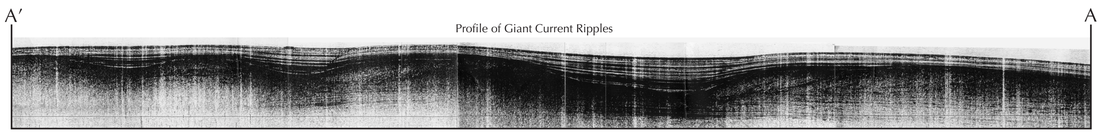
Reviewed by Wendy J. Gerstel, Washington State Division of Geology and Earth Resources.

Digital cartography by Jane S. Freed, Loudon R. Stanford, and Alan K. Schlerf.

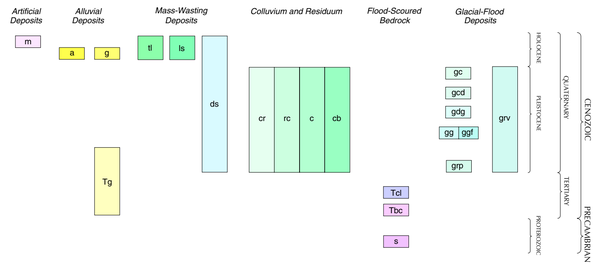
Idaho Geological Survey Digital Mapping and GIS

Profile of Giant Current Ripples



This seismic profile between Tubbs Hill and North Cape shows the sediments underlying Coeur d'Alene Lake. It reveals the presence of giant current ripples in the lake basin emplaced by the latest Missoula Floods. Cross bedding in the ripples is readily apparent. The high energy bedforms are draped with late Pleistocene outwash of nonflood origin and finer Holocene sediments. Some slumping of the dip face is noticeable. Source: Seismic profile collected by P. Woods, U.S. Geological Survey. No vertical scale.

CORRELATION OF MAP UNITS



INTRODUCTION

This map product addresses the increasing demand for geologic information in urban areas. The area covered by the map is experiencing the most rapid growth in Idaho. The geologic mapping was funded in part by STATEMAP, a national cooperative program of the U.S. Geological Survey with the state geological surveys.

The map represents the geology of the materials and soils exposed near the earth's surface. The thickness of these deposits varies from a few feet in the upland areas to hundreds of feet in the Rathdrum Valley. The map is useful for determining the type and characteristics of the geologic materials found at the surface and in the shallow subsurface by agricultural activities, building excavations, construction material excavations, ditches, and well holes. The information can be used by government, industry, and the public for planning, development, and resource characterization. The map provides new information about the Rathdrum Aquifer, the sole source water supply for over 400,000 people in Idaho and Washington. The map can be used as a guide for site locations but is not intended as a substitute for a detailed, site-specific geotechnical evaluation. This is particularly true in the more urbanized areas where access and exposures are limited and human activity has concealed the geology.

Most users of geologic maps are more familiar with traditional lithologic descriptions of bedrock units. Surficial maps show units with more diverse characteristics than rock type or lithology. Most surficial deposits are geologically young, Quaternary in age, and unconsolidated. The Quaternary units are subdivided on the basis of their physical characteristics and the boundaries between them (allostratigraphy). In many places, the boundaries between these units are manifested by morphologic features.

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

m — **Made ground (historical)**—Manmade deposits include disturbed, transported, and emplaced construction materials derived from various local sources. Includes the following areas and activites: land along Interstate-90 and major interchanges where earthmoving has changed the landscape morphology; and industrial sites along the waterfront and beachfront that have been bermed or filled. Many smaller sites of made ground are common in urban areas but are not mapped.

ALLUVIAL DEPOSITS

a — **Alluvium and lacustrine sediments (Holocene)**—Alluvial silt and sand deposits of Cougar Creek and Kidd Island Creek interfinger with lacustrine silt deposits of Coeur d'Alene Lake at deltas in Cougar Bay and Kidd Island Bay. Locally includes peat and bog deposits in the creek bottom wetlands. These deposits are located in the modern flood plain of the creeks and within the high-water elevation of Coeur d'Alene Lake. The normal pool elevation of the lake is 2,125 feet.

g — **Alluvial gravels (Holocene)**—Sandy pebble to boulder gravels and sands. Mostly consists of reworked Pleistocene outwash and flood deposits. Forms a persistent terrace at 2,140 feet along the Spokane River above the Post Falls Dam (4 miles down river from the western edge of the map).

Tg — **Lag gravels on relict alluvial surfaces (Tertiary)**—Cobble and pebble gravels consist of mature rounded quartzites and mixed lithologies derived from the Precambrian Belt Supergroup rocks and Mesozoic-Tertiary intrusives. Matrix of weathered saprolite. Exposed on flat upland surfaces in Cougar Creek and Kidd Island Creek valleys. The gravel surfaces probably are graded to the blockages caused by the Miocene plateau basalts. They range in elevation from 2,400 feet in Cougar Creek to 2,600 feet on Mica Flats. Generally the deposit is thin, 1 to 5 feet, and at depth grades into saprolite soils or Miocene paleosols.

MASS-WASTING DEPOSITS

ls — **Landslide deposits (Holocene and late Pleistocene)**—Mixture of unconsolidated angular rock fragments and finer matrix materials derived from local outcrops. Locally includes talus and smaller landslide deposits of unit *tl*. Thickness as much as 50 feet.

tl — **Talus and landslide deposits of Columbia River Basalt Group (Holocene and late Pleistocene)**—Poorly sorted and poorly stratified angular cobbles and boulders with mixed silts and clays. Mass movement slope deposits mainly associated with basalt rimrock and the interbedded sediments around the Coeur d'Alene Lake basin. Gradations from talus to landslide are present and difficult to distinguish. Thickness as much as 40 feet.

ds — **Debris-flow and solifluction deposits (Quaternary)**—Composed of angular pebbles and cobbles in a silty sand matrix. Overlies weathered bedrock on north-facing steep slopes that emanate from the higher-elevation mountains. Probably periglacial in origin and Pleistocene in age. Surface typically mantled by 1-2 meters of loess and volcanic ash with weakly developed Holocene soil horizons (Weisel, 1981).

COLLUVIUM AND RESIDUUM

cr — **Colluvium and residuum of intermediate depth (Quaternary and Tertiary)**—Colluvium is composed of pebble gravel in a clayey, silty sand matrix. The coarseness of the gravel typically increases with depth. Residuum is mostly a sandy silt saprolite that grades with depth into Precambrian granodiorite, tonalite, and diorite gneisses. The unit is predominant on steep slopes and is gradational with areas of common small rock outcrops (*c*), colluvium and bedrock that form linear, erosion-resistant ridges (*cb*), and debris-flow and solifluction deposits (*ds*). Residuum is thickest on south-facing, gentle slopes. Near Mica Flats, areas of gentle, south-facing slopes have a 3-foot or greater mantle of loess over buried, clayey soil horizons (Weisel, 1981) that are Pleistocene in age.

rc — **Residuum and colluvium composing deep regolith (Quaternary and Tertiary)**—Residuum is mostly a sandy silt saprolite that grades with depth into Precambrian gneiss. Colluvium typically is shallow to deep, pebbly and cobbly silty sand that mantles the residuum. The residuum is relict from Tertiary weathering of bedrock and is thickest on stable remnant surfaces where it is associated with Tertiary lag gravel (*Tg*). Locally, a silty clay buried soil occurs within 1.5 to 3 feet of the surface (Weisel, 1981).

c — **Colluvium and common small rock outcrops (Quaternary and Tertiary)**—Colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix that overlies relatively unweathered gneiss, schist, and quartzite. The unit is associated with quartzite ridges at higher elevations and areas partially eroded by Lake Missoula catastrophic floods. Typically lacks a mantle of loess and well-developed soil horizons (Weisel, 1981). Thickness is 1.5 to 6 feet.

cb — **Colluvium and bedrock that form linear, erosion-resistant ridges (Quaternary and Tertiary)**—The thin and discontinuous colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix. Bedrock outcrops are composed of Precambrian gneiss and arkosic quartzite. Ridges parallel the strike of the regional foliation, located over a range of elevations, but are prominent at higher elevations where erosion predominates over deposition. Lacks a mantle of loess and well-developed soil horizons (Weisel, 1981).

GLACIAL FLOOD AND PERIGLACIAL DEPOSITS

Gravels of Rathdrum Prairie

The gravel deposits are the result of repeated catastrophic flood releases from Pleistocene glacial Lake Missoula that persisted until 12,000 years ago. Post Falls is about 30 miles downstream from the Pleistocene Clark Fork ice dam and 15 miles from the end of Lake Pend Oreille, where most of the floodwaters were channeled. Within the Rathdrum Prairie the proximal deposits consist mostly of boulder gravels with interbedded sands emplaced by high flow regimes. Crude bedding and clast-supported boxwork textures are common. Early geologists in the region interpreted the valley gravels as glacial deposits. The actual limits of the Pleistocene advances of the Purcell Trench lobe are unknown due to catastrophic floods sweeping the area. Today's understanding of the repeated ice dam failures has led most researchers to consider the gravels as flood, not glacial, in origin. Tributary valleys along the sides of the Rathdrum Prairie are filled with finer bedded flood deposits of sand and gravel. Early geologic reports attributed the tributary valley fills and associated lakes to damming by lateral moraines or kame terraces. We now know they are giant eddy bars. These gravels are irregularly mantled with loess, volcanic ash, and a component of silt from glacial Lake Missoula. They are also sporadically cemented with calcium carbonate in varying stages of development, from only rinds on the bottom of clasts to a nearly complete filling of the pore space (Breckenridge and others, 1997b).

Proximal Deposits on the Floor of Rathdrum Prairie

gc — **Channel gravels undivided (Pleistocene)**—Late Wisconsin flood gravels and sands deposited in channelways cut into high energy fans and bar features. Moderately sorted and stratified from lower flow regimes. The channels are commonly developed at the margin of the prairie because the larger boulders armor the center of the flood path. Locally includes angular basalt columns derived from the basalt rimrock. Soils of the Kootenai series (Weisel, 1981). Thickness 10 to 40 feet.

gdg — **Gravel of Dalton Garden fan (Pleistocene)**—Poorly sorted sandy gravel deposited in large fan formed downstream from Hayden Lake outlet. Lobate in form at the downstream margin. Soils of the Avonville series (Weisel, 1981). Thickness 10 to 50 feet.

gcd — **Gravel of Coeur d'Alene (Pleistocene)**—Mixed deposits of poorly to moderately sorted stratified cobbly sands and sandy gravels carried by outburst floods and also currents of reverse outflow from Coeur d'Alene Lake. Soils of the McGuire series (Weisel, 1981). Forms giant current ripples in the lake bottom revealed by seismic profiles (see cross section). Thickness 20 to 80 feet.

gg — **Gravel of Green Ferry (Pleistocene)**—Coarse flood gravels. Consists of an extensive sheet of flood deposits, graded to about 2,200 feet at Post Falls. Characterized by poor sorting and variation in bedding. Probably represents the last episode of major flood events. The unit is locally sandy, especially in the lee of Ross Point where steeply dipping, thick-bedded sands are concentrated. Soils of the McGuire series. Thickness in excess of 100 feet.

ggf — **Gravel of Green Ferry fan facies (Pleistocene)**—Poorly sorted, sandy flood gravels with channel cut and fill structures. Formed by large coalescing fan complex characterized by scour and fill features and concentrations of lag boulders. Margins characterized by numerous lobe forms. Dissected by waning phases of flooding and smaller, later flood events. Soils of the Avonville series (Weisel, 1981). Thickness 10 to 80 feet.

grp — **Gravel of Ross Point (Pleistocene)**—Coarse, stratified sandy gravel forms the highest preserved remnant flood terrace in the quadrangle at about 2,340 feet in elevation. Has the most soil development of the Rathdrum Prairie gravels, the Avonville-Marble association (Weisel, 1981). Represents the earliest of the flood deposits recognized in the area. Thickness more than 150 feet.

Distal Deposits Along Valley Sides and Tributaries

grv — **Gravel of Riverview Drive (Pleistocene)**—Sandy flood gravels on the southern margin of Rathdrum Prairie in the mouths of tributary drainages. Bedded low-flow regime deposits formed in eddy bar environment. Thickness 60 to 80 feet.

FLOOD-SCOURED BEDROCK

Tbc — **Basalt scoured by Missoula Floods (Miocene)**—Basalt of Columbia River Basalt Group. Forms sporadic rimrock along the margins of Rathdrum Prairie, mostly eroded by Pleistocene glaciation and repeated Missoula Floods. May be present in the subsurface of Rathdrum Prairie (Breckenridge and others, 1997a). The Priest Rapids Basalt and Grande Ronde Basalt are present in the area. The table below gives the chemical type and magnetic polarity of the samples.

Tcl — **Tertiary clay deposits (Miocene)**—Tertiary clay deposits of the Latah Formation. Stockton clay deposit on Blackwell Hill mapped by Scheid (Hosterman and others, 1960)

s — **Precambrian metamorphic rocks of the Belt Supergroup and gneiss, schist, and granites scoured by Missoula Floods (Precambrian)**—Mapped as Pritchard Formation by Griggs (1973) and undivided metamorphic rocks by Weis (1968) south of Rathdrum Prairie.

MAP SYMBOLS

Contact: dashed where approximately located

Abandoned channels of Lake Missoula Floods drainageways; generally erosional pathways during waning flows

Channels scoured in bedrock by Lake Missoula Floods; on margins of Rathdrum Prairie mostly on spurs and divide crossings

Theoretical maximum inundation level of Lake Missoula Floods (2,600 feet)

Slope face of gravel flood bar or erosional scarp

Stippled areas represent depositional surfaces of remnant flood bars

Bathymetric contours in meters (Woods and Berenbrock, 1994)

Location of basalt sample (see table)

Digital Orthophoto of Coeur d'Alene Quadrangle (1992)

Idaho Department of Lands digital orthophoto

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Basalt Analyses

Sample	Location Latitude	Location Longitude	Chemical Type	Magnetic Polarity
1	47°37'34"	116°46'07"	GR	N
2	47°37'48"	116°46'08"	GR	R
3	47°40'36"	116°48'10"	GR	N
4	47°44'23"	116°48'49"	PR	*
5	47°40'09"	116°49'46"	GR	N
6	47°40'05"	116°50'46"	PR	R
7	47°41'36"	116°52'15"	GR	N

GR = Grande Ronde Basalt; PR = Priest Rapids Basalt; N = normal polarity; R = reversed polarity

* No paleomagnetism run

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