SURFICIAL GEOLOGIC MAP OF THE HAYDEN LAKE QUADRANGLE, KOOTENAI COUNTY, IDAHO

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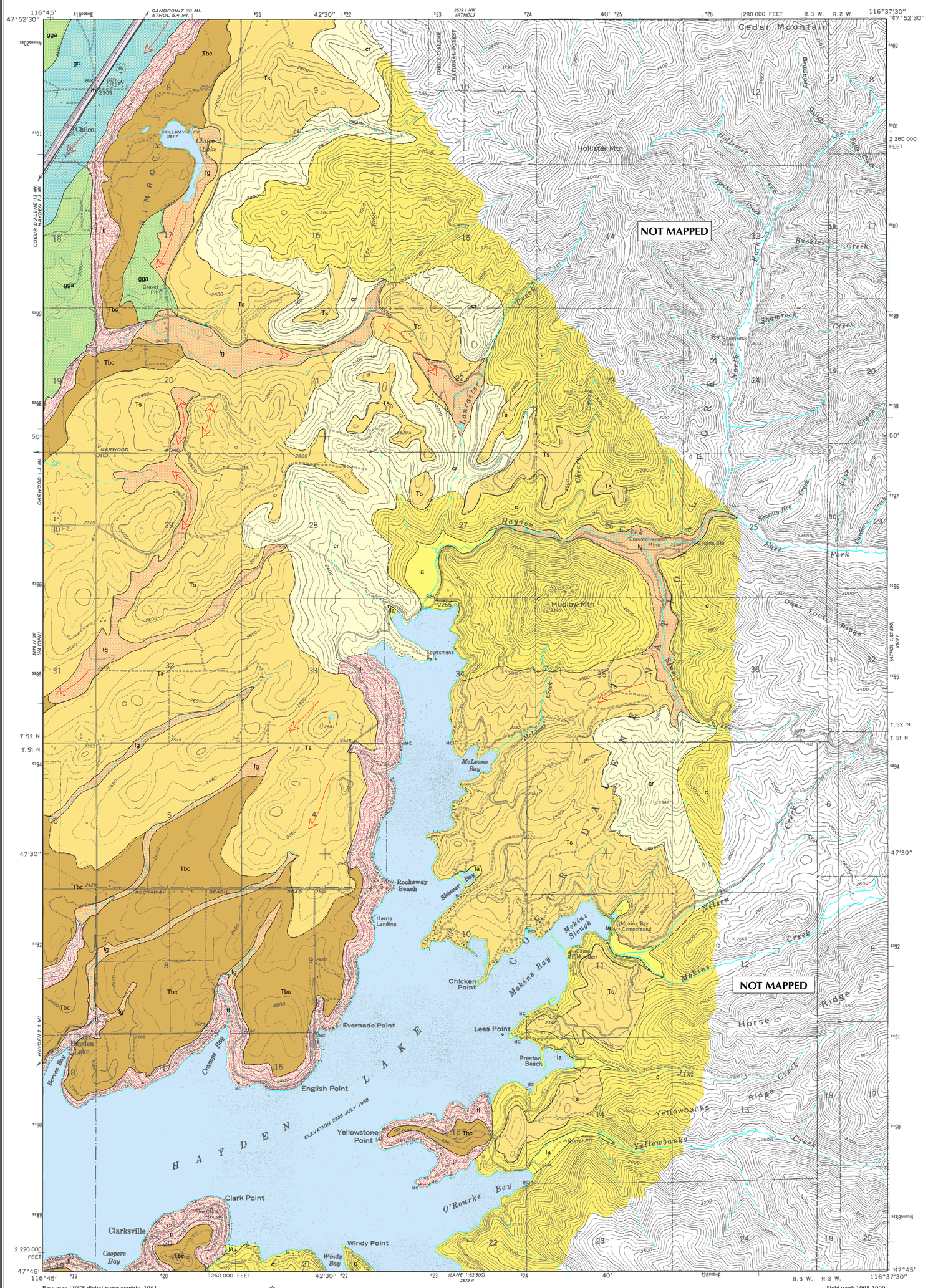
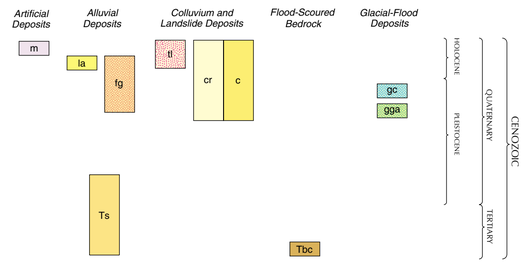
2000



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 some of 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 Hayden Lake quadrangle is located at the edge of the Rathdrum Prairie and the Coeur d'Alene Mountains. Elevations range from over 4,320 feet at the top of Hollister Mountain to 2,238 feet on Hayden Lake, the predominant physiographic feature of the quadrangle. The 180-foot-deep lake is dammed by glacial flood gravels and has no established surface water outlet; in the subsurface it recharges the Rathdrum aquifer. The mountains surrounding the lake on the north and east are composed of Precambrian Belt Supergroup siltites, argillites, and quartzites. A granitic pluton of Cretaceous or Tertiary(?) age intrudes the belt rocks and is exposed along the shore between O'Rourke and McLeans bays. The plateau west of the lake is underlain by Miocene lavas of the Columbia River Basalt Group. Most of the plateau is covered by ancient soils preserved since the Miocene and exhumed by erosion mainly from the catastrophic Pleistocene floods of glacial Lake Missoula. The Hayden Lake embayment was marginal to the main outburst channel and was inundated as high as 2,600 feet in a large eddy.

The map represents the geology of the materials and soils exposed near the earth's surface. The thicknesses of these deposits range 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 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 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 U.S.95 and railroad right-of-ways where earthmoving has changed the landscape morphology. Many smaller areas of made ground have not been mapped and include berms and fills along waterfronts and beachfronts.

ALLUVIAL DEPOSITS

la **Lacustrine sediments and alluvium (Holocene)**—Silt and sand deposits in bays of Hayden Lake. The deposits are located within the high-water zone of the lake and are interbedded with alluvial deposits from tributary streams.

Fluvial Gravels

fg **Fluvial gravels (Pleistocene and Holocene)**—Sandy gravel and sandy silt in abandoned drainageways of the last Lake Missoula floods. The Hayden Lake area was inundated by the largest releases from glacial Lake Missoula but was outside the effective flow boundary, probably in a large eddy (O'Connor and Baker, 1992) where erosion by flood water was limited. The unit is mostly reworked Miocene sediments and colluvium that were deposited by slack-water flows. Includes varied thicknesses of Holocene alluvium and wetland bog deposits. Soils are deep, poorly drained, silt loams of the Potlatch series and Seelovers complex (Weisel, 1981). Thickness up to 10 feet.

Ts **Relict alluvium (Tertiary)**—Cobbly and pebbly sand and silt derived from Precambrian Belt Supergroup rocks and Mesozoic-Tertiary intrusive rocks. Matrix composed of weathered saprolite and clay (plinthite) paleosols (McDaniel and others, 1998a, 1998b, 1998c) of the Mokins series (Weisel, 1981). In the western part of the map, the unit forms a flat to gently sloping upland surface, 2,400-2,600 feet in elevation, that is underlain by basalt of the Priest Rapids Member of the Wanapum Basalt. Eastward, the unit grades into a thick weathered mantle overlying pre-Tertiary rocks. Some relict surfaces are as high as 2,800 feet in elevation. The alluvial deposits are probably graded to high base levels formed when the Miocene plateau basalts blocked and diverted stream drainages (Othberg and Breckenridge, 1998). The unit is finer grained but correlated to the Tertiary gravels (*Tg*) mapped on the adjacent Coeur d'Alene (Breckenridge and Othberg, 1999) and Fernan quadrangles. Generally the deposit is thin, from 1 to 7 feet, and in the western part of the map shows morphology modified by repeated Lake Missoula floods.

COLLUVIUM AND LANDSLIDE DEPOSITS

tl **Talus and landslide deposits of Columbia River Basalt Group (Holocene and late Pleistocene)**—Poorly sorted and poorly stratified angular basalt cobbles and boulders mixed with silts and clays. Mass-movement slope deposits mainly associated with basalt rimrock and the interbedded sediments. Locally may include basalt columns from either mass movements or flood waters in cataracts. Gradations from talus to landslide deposits are present and difficult to distinguish. Thickness as much as 40 feet.

cr **Colluvium and residuum (Quaternary and Tertiary)**—Colluvium is composed of angular to subrounded pebble and cobble gravel in a silty sand matrix, 1 to 4 feet thick. The coarseness of the gravel and the matrix typically increases with depth as the colluvium grades into Mesozoic granite or Precambrian argillite, siltite, and quartzite. Residuum is a clayey to silty, sandy saprolite, typically more than 6 feet thick, that grades with depth into bedrock. The residuum is relict from Tertiary weathering of bedrock and is thickest on stable remnant surfaces where it is associated with Tertiary alluvium (*Ts*). The unit is predominant on lower, gentler slopes and grades into colluvium and common small rock outcrops (*c*).

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 granite, quartzite, siltite, and argillite. Includes areas of bedrock that form linear, erosion-resistant ridges. Where slopes are steep and along the shore of Hayden Lake, the unit includes landslide and debris-flow deposits.

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 about 12,000 years ago. Hayden is about 20 miles downstream from the Pleistocene Clark Fork ice dam and 15 miles from the end of Lake Pend Oreille where most of the floods were channeled. Early geologists in the region interpreted the valley gravels as glacial deposits with lateral moraines and kame terraces damming the tributaries and forming lakes such as Hayden. The actual limits of the Pleistocene advances of the Purcell Trench lobe are unknown because of the catastrophic floods that swept the area. Richmond and others (1965) interpreted deposits near Rockaway Beach as pre-Wisconsin till. Today's understanding of the repeated ice dam failures has led most researchers to consider the gravels as flood, not glacial, in origin; yet the pre-late Wisconsin ice margin is unclear.

Within the Rathdrum Prairie, the proximal deposits consist mostly of boulder gravels with interbedded sands deposited by high flow regimes. Crude bedding and clast-supported boxwork textures are common. Tributary valleys along the sides of the Rathdrum Prairie are filled with more finely bedded flood deposits of sands and gravel. 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).

gc **Channel gravels, undivided (Pleistocene)**—Latest Wisconsin flood and outwash 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. Surface soils are gravelly loam of the Kootenai series (Weisel, 1981). Thickness 10 to 40 feet.

gga **Gravel of Garwood (Pleistocene)**—Poorly sorted sandy gravel deposited in a large fan formed downstream from the flood outlet of Lake Pend Oreille. Represents one of the last recognizable flood events. Includes local fans composed of gravel contributed from side drainages and rimrock basalt. Surface soils are gravelly silt loam soils of the Kootenai series and silt loams of the Bonner series (Weisel, 1981). Thickness 10 to 50 feet.

FLOOD-SCOURED BEDROCK

Tbc **Basalt scoured by Missoula Floods (Miocene)**—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 Member and Grande Ronde Basalt are recognized in the area. Shallow surface soils are the stoney and sandy loams of the McGuire series and the stony clay loam of the Lacey-Bobbitt association (Weisel, 1981). Locally scattered flood erratics are common. Surface deposits are 2 to 15 feet thick and grade east and northeast into a flood-modified surface of Tertiary alluvium (*Ts*).

SYMBOLS

Contact: dashed where approximately located.

Abandoned channels of Lake Missoula Floods drainageways; generally erosional pathways occupied by eddy flows of floods

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Base map USGS digital raster graphic, 1961.

Control by USGS and NOS/NOAA.

Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1961.

Polyconic projection. 10,000-foot grid based on Idaho coordinate system, west zone.

1927 North American datum.

National geodetic datum of 1929.

UTM grid and 1961 magnetic north declination at center of sheet.

SCALE: 1:24,000

1 MILE 1/2 0

1 KILOMETER 0.5 0

Contour interval 40 feet.
Dotted lines represent 20-foot contours.

IDAHO

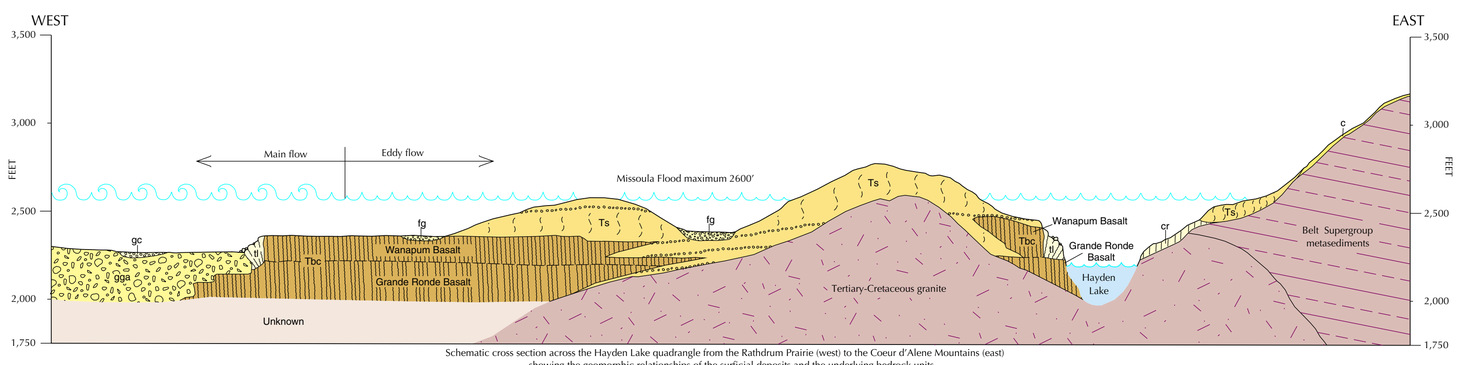
QUADRANGLE LOCATION

Field work 1998-1999.

Field work and map preparation funded in part by the U.S. Geological Survey's STATEMAP program.

Reviewed by Reed S. Lewis, Idaho Geological Survey.

Digital cartography by Jane S. Freed at the Idaho Geological Survey's Digital Mapping and GIS Lab.



Schematic cross section across the Hayden Lake quadrangle from the Rathdrum Prairie (west) to the Coeur d'Alene Mountains (east) showing the geomorphic relationships of the surficial deposits and the underlying bedrock units.

Digital Orthophoto of Hayden Lake Quadrangle (1992)

Idaho Department of Lands digital orthophoto

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