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GEOLOGIC MAP SERIES, SCALE 1:100,000
OTHBERG AND STANFORD

GEOLOGIC MAP OF THE BOISE VALLEY AND ADJOINING AREA, WESTERN SNAKE RIVER PLAIN, IDAHO

BY KURT L. OTHBERG AND LOUDON R. STANFORD

1992

MAP UNITS

SEDIMENTARY

QUATERNARY SEDIMENTS

Alluvium and Colluvium

Deposits of floodplains, alluvial fans, side-stream terraces, and landslides.

Qa — ALLUVIUM OF BOISE AND SNAKE RIVER — Sandy cobble gravel upstream grading to sandy pebble gravel downstream. Mostly channel alluvium of the Boise and Snake rivers. Thickness 6-14 meters (20-46 feet). No pedogenic clay.

Ql — LANDSLIDE DEPOSITS — Highly variable rock and soil masses varying from transported coherent blocks to unsorted, unstratified colluvium. Includes scar area at the head of the landslide. Derived from slumps, slides, and debris flows. Most slides represent slope failures within basaltic tuff (Tbt) and surface soils of granitic rocks.

Qfg — ALLUVIAL FAN GRAVEL — Sandy pebble and cobble gravel where formed from reworked Tenmile Gravel (QTtg) and sand and granule gravel where formed from weathered granite (g). Primarily formed by Pleistocene debris flows and local high-energy streams during times of greater runoff (Pierce and Scott, 1982). Loess 1-2 meters thick discontinuously covers surface of gravel. Patterned ground present. Amount of pedogenic clay and presence of duripans varies.

Qas — SANDY ALLUVIUM OF SIDE-STREAM VALLEYS AND GULCHES — Medium to coarse sand interbedded with silty fine sand and silt. Sediment mostly derived from weathered granite and reworked Tertiary sediments. Thickness variable. Minor pedogenic clay and calcium carbonate.

Qfs — SAND OF INCISED ALLUVIAL FANS — Medium to coarse sand interbedded with silty fine sand and silt. Mostly reworked Tertiary sediments deposited in local alluvial fans. Thickness 1-15 meters (3-50 feet). Pedogenic clay 10-20%; duripans locally present.

Qafs — SAND OF DRY CREEK TERRACE — Medium to coarse sand interbedded with silty fine sand and silt. Remnant of ancestral Dry Creek valley. Pedogenic clay 10-20%; duripans locally present.

Qafrg — GRAVEL OF ALLUVIAL-FAN REMNANTS — Dark gray, poorly sorted, sandy pebble and cobble gravel. Gravel clasts subangular and subrounded. Thickness 3-6 meters (10-20 feet). Mapped only where channel deposits of ancestral Squaw Creek cap remnants of a large alluvial fan in southwest corner of map.

Bonneville Flood Deposits

Consists primarily of fine-grained sediments of the Bonneville Flood slack waters that inundated the Snake River Valley and the lower Boise Valley. Includes gravels deposited in high-energy flood channels. The surface of sediments deposited by the Bonneville Flood show minor accumulations of pedogenic clay and calcium carbonate. Slack-water sediments bury loess and soils of older surfaces.

Qbgc — CLAY OF BONNEVILLE FLOOD SLACK WATER — Light tan silty clay 1-2 meters (3-7 feet) thick. Deposited by slack water of Bonneville Flood upstream from Parma. Buries gravel of Boise terrace.

Qs — SANDY SILT OF BONNEVILLE FLOOD SLACK WATER OVERLYING TERTIARY SEDIMENTS — Thin-bedded tan silt, silty sand, and fine sand 3-6 meters (10-20 feet) thick. Deposited by Bonneville Flood slack water that flooded the valleys to 747 meters (2,450 feet) elevation (O'Connor, 1990). Buries erosion surface of fine-grained Tertiary sediments.

Qbfg — GRAVEL OF THE BONNEVILLE FLOOD-SCOURED BOISE TERRACE AND BOISE FLOODPLAIN COMPLEX — Sandy pebble gravel remnants of Boise terrace mostly scoured by late stages of Bonneville Flood. Includes areas of floodplain gravel indistinguishable from scoured Boise terrace.

Qwgs — SANDY SILT OF BONNEVILLE FLOOD SLACK WATER — Thin-bedded tan silt, silty sand, and fine sand 3-6 meters (10-20 feet) thick. Deposited by Bonneville Flood slack water that flooded valleys to 747 meters (2,450 feet) elevation (O'Connor, 1990). Buries gravel of Whitney terrace (Qwg).

Qwfg — GRAVEL OF THE BONNEVILLE FLOOD-SCOURED WHITNEY TERRACE — Sandy pebble gravel remnants of Whitney terrace scoured by late stages of Bonneville Flood. Includes abandoned flood channels. Loess mostly removed. Local remnants of duripans similar to those on Qwg.

Qwlg — SANDY SILT OF BONNEVILLE FLOOD SLACK WATER — Thin-bedded tan silt, silty sand, and fine sand 3-6 meters (10-20 feet) thick. Deposited by Bonneville Flood slack water that flooded valleys to 747 meters (2,450 feet) elevation (O'Connor, 1990). Extent of slack-water sediment not everywhere concordant with interpreted extent of flood waters. Buries thin loess, duripan, and sandy pebble gravel of Wilder terrace, the third terrace above the floodplain in the western Boise Valley. Gravel thickness 3-8 meters (10-25 feet).

TERRACE GRAVELS

These gravels compose a sequence of terraces of the ancestral Boise River. The characteristic coarse channel gravels were primarily deposited on fine-grained Tertiary sediments cut during valley deepening. The light gray gravel is composed mostly of granitic and felsitic clasts derived from the upper Boise River basin in the central Idaho mountains. Qgg and younger gravels have about a 10% component of Pleistocene basalt clasts mostly derived from the Boise River. Boise Valley units are also used for terrace gravels of the Snake River, but Snake River gravels have a darker color due to a component of gravel clasts derived from the Owyhee Mountains and sources to the southeast. All gravel deposits have imbricated well-rounded clasts, poor sorting, and crude stratification of beds of gravel and lenses of cross-bedded sand. These features suggest deposition in braided channels.

Qbg — GRAVEL OF THE BOISE TERRACE — Sandy pebble and cobble gravel. First terrace above the floodplain. Thickness 3-14 meters (10-45 feet). Mostly mantled with thin loess.

Qg — GRAVEL OF BOISE FRONT TERRACES, UNDIVIDED — Sandy pebble and cobble gravel with subangular boulders. Thickness 1-6 meters (3-20 feet) thick. Forms terraces along canyons and gulches and on flat divides near the margin of the foothills.

Qwg — GRAVEL OF WHITNEY TERRACE — Sandy pebble and cobble gravel. Second terrace above floodplain. Thickness 5-24 meters (16-80 feet); thickest to the east. Mantled with 1-2 meters of loess.

Qsg — GRAVEL OF SUNRISE TERRACE — Sandy pebble and cobble gravel. Third terrace above the floodplain. Thickness about 13 meters (44 feet). Mostly mantled with 1-2 meters of loess.

Qgg — GRAVEL OF GOWEN TERRACE — Sandy pebble and cobble gravel. Fourth terrace above the floodplain. Buried by basalt (Qgb) east of Interstate 84. Terrace gravel overlies the gravel and sand of Bonneville Point (Tbg) to the east and fine-grained Tertiary sediments to the west. Mostly mantled by 1-2 meters (3-7 feet) of loess.

Qdg — GRAVEL OF AMITY TERRACE — Sandy pebble and cobble gravel grading at depth to coarse pebbly sand. Seventh terrace above the floodplain. Gravel and sand is about 10 meters (33 feet) thick. Northwest-trending, gently sloping escarpments suggest faulting of the gravel. Mantled with loess 0.5-2 meters (2-7 feet) thick.

Qdg — GRAVEL OF DEER FLAT TERRACE — Sandy pebble gravel grading at depth to coarse pebbly sand. Deposited on the fourth terrace above the floodplain in the western Boise Valley. North of Caldwell and Middleton Tertiary sediments are exposed between terrace remnants. Boise River gravels also interfinger with and are replaced northeastward by Willow Creek alluvial fan sand and gravel. Gravel and sand deposit is about 10 meters (33 feet) thick. Mantled with loess 1-4 meters (3-13 feet) thick.

Qdgs — GRAVEL OF DEER FLAT AND PRE-DEER FLAT TERRACES, UNDIVIDED — Sandy pebble and cobble gravel. Alluvial fan deposits of the ancestral Willow Creek interfingering and mixing downstream with channel alluvium of the ancestral Boise River. Deposited on stream-cut surface of fourth and fifth terrace above the floodplain. Tertiary sediments are exposed between terrace remnants. Mostly mantled with loess 0.5-1 meter (2-3 feet) thick.

QTtg — TENMILE GRAVEL — Sandy pebble and cobble gravel grading westward to sandy pebble gravel and pebbly sand at depth. Eighth terrace above the floodplain in the eastern Boise Valley. Remnants in the western Boise Valley form the fifth terrace above the floodplain. Side slopes of remnants expose underlying Glenns Ferry Formation. Thickness is about 15 meters (50 feet). Several normal faults exposed in gravel pits and road cuts. Surface of terrace shows prominent northwest-trending gulches and gently sloping fault-line escarpments. Mostly mantled with loess 1-2 meters (3-7 feet) thick. Patterned ground prominent. Named by Savage (1958); restricted by Wood and Anderson (1981); further restricted herein to exclude the gravel and sand of Bonneville Point formation (Tbg).

TERTIARY SEDIMENTS

Tps — SAND OF THE PIERCE GULCH FORMATION — Pale yellow-gray arkosic sand overlain by pebble to cobble gravel. Sand includes cross-bedded and foreset-bedded sequences. Named by W.L. Burnham and S.H. Wood (written communication–unpublished manuscript, 1989).

Tgf — GLENNS FERRY FORMATION — Greenish gray poorly consolidated siltstone and fine sandstone. Distinct thick beds; indistinct thin bedding. Includes tan sandstone in Dead Horse Canyon.

Tbg — GRAVEL OF BONNEVILLE POINT — Interbedded pebble and cobble gravel, pebbly sand, sand and buried soils. Mostly oxidized to yellow-orange grading to red-brown near surface. Half of the clasts weathered. Mostly channel alluvium of ancestral Boise River deposited in former valley at mountain front. Thickness about 152 meters (500 feet). Soils have B horizons with 50% clay. The upper part of the gravel contains a highly oxidized, partly cemented zone. Several normal faults exposed in gravel pits and road cuts. Patterned ground present with mound relief of 1-2 meters.

Tfl — ALLUVIAL FAN DEPOSIT — Composed of poorly sorted, silty and sandy gravels with subangular cobbles and boulders in crudely stratified layers and lenses; mostly oxidized to a red-brown near the surface. Alluvial fan remnants deposited by debris flows and ephemeral streams from foothills. Up to 61 meters (200 feet) thick.

Ts — SAND AND MUDSTONE OF STREAM AND LAKE SEDIMENTS — Medium- to coarse-grained arkosic sand, sandstone, and claystone. Includes interbeds of fine gravel, locally cemented, and sandy siltstone. Structures vary from large foreset beds of sand to thin-bedded claystone. Undifferentiated unit reflects a variety of stream and lake depositional environments along the northeastern and southwestern margin of the ancestral western Snake River Plain. Includes parts of the Payette, Poison Creek, and Succor Creek Formations, the tuffaceous sediments of Ferns (1989), and the Terteling Springs Formation of W.L. Burnham and S.H. Wood (written communication–unpublished manuscript).

IGNEOUS ROCKS

QUATERNARY BASALTS

Basalt lava flows primarily erupted from three sources during the Pleistocene: the northwest-southeast axis of the western Snake River Plain; Smith Prairie (Howard and others, 1982); and along the edge of the plain southeast of Boise. The basalts inundated ancestral valleys and plains. Their resistance to erosion helped preserve the terrace remnants they cap. The early Pleistocene basalt flows diverted the Boise River northward and the Snake River westward.

Qbs — BASALT OF MORES CREEK — Single flow of dark gray olivine basalt about 6 meters (20 feet) thick. Fine-grained with abundant microphenocrysts of plagioclase and common microphenocrysts of olivine. Canyon-filling lava erupted from unknown vent in Mores Creek valley (Howard and others, 1982). Identified in ledges, normally submerged in reservoirs near Lucky Peak Dam.

Qgb — BASALT OF GOWEN TERRACE — Four flows of medium gray olivine basalt. Hand samples and thin sections show sparse phenocrysts of olivine up 1-3 millimeters in diameter. Canyon-filling lava probably erupted in Smith Prairie (Howard and others, 1982). Buries gravel of Gowen terrace; basalt surface capped with about 3 meters (10 feet) of terrace gravel at distal end. Thickness of basalt ranges from about 3 meters (10 feet) near Boise to about 61 meters (200 feet) near Lucky Peak Dam. Mostly mantled with loess 1-2 meters (3-7 feet) thick. Pedogenic clay 35%; duripan (caliche) 0.5-1 meter thick.

Qbp — BASALT OF LUCKY PEAK — Single flow of dark gray to black aphyric very fine-grained basalt. Canyon-filling lava probably erupted in Smith Prairie (Howard and others, 1982). Basalt buries gravel composing fifth terrace above the floodplain. Thickness of basalt about 37 meters (121 feet). Upper surface mostly buried by alluvial fan deposits (Qfg).

Qkb — BASALT OF KUNA BUTTE — Dark gray olivine basalt flow forming irregular topography southeast of Nampa. Common phenocrysts of olivine 1-5 millimeters in diameter. Thickness unknown. Erupted from northwest end of Kuna Butte. Pedogenic clay 10-20%; duripans locally present.

Qfb — BASALT OF FIVEMILE CREEK — One to three flows of medium gray olivine basalt. Thin sections show a cumulophyric texture of a few percent small interlocking olivine grains. Erupted from small vent near headwaters of Fivemile Creek. Basalt buries gravel composing sixth terrace above the floodplain. Thickness ranges from about 3 meters at the west edge of the flow to about 55 meters (180 feet) at the east. Mostly mantled with loess 1-2 meters thick. Pedogenic clay 35%; duripan (caliche) 0.5-1 meter thick. Patterned ground present.

Qib — BASALT FLOWS OF INDIAN CREEK, UNDIVIDED — Multiple flows of medium to dark gray olivine basalt. Undivided basalts generally aphyric but include flows with small olivine and plagioclase phenocrysts. Erupted from vents south and southeast of the map. Both normal and reversed magnetic polarities. Lavas flowed into and down ancestral Indian Creek and Boise River valleys. Northwest-trending, gently sloping escarpments suggest faulting of the basalt. Mantled with loess 0.5-4 meters thick. Pedogenic clay 35%; duripan (caliche) 1 meter thick.

Qibs — BASALT FLOWS OF INDIAN CREEK BURIED BY LOESS AND STREAM SEDIMENTS — Tan massive silt, light brown stratified clay, silt, and sand, and basalt 6-15 meters (20-50 feet) deep. Location of basalt based on water well logs and subcrop mapping by Wood and Anderson (1981). Pedogenic clay 10-20%; duripans locally present.

Qudb — BASALT FLOWS OF UPPER DEER FLAT, UNDIVIDED — Multiple flows of dark gray aphyric olivine basalt. Reversed magnetic polarities. Probably erupted from one or more vents south of the map. Mantled with loess 1-4 meters (3-13 feet) thick. Pedogenic clay in loess 10-20%; calcium carbonate in B horizon. Loess buries duripan (caliche) 1 meter thick formed in the top of the basalt.

Qbsc — BASALTIC VENTS, UNDIVIDED — Olivine basalt and basaltic tephra forming dissected cones and volcanic necks near the Snake River.

TERTIARY BASALTS

Tbdp — BASALT OF PICKET PIN CANYON — Dark gray basalt flow with a cumulophyric texture of distinctive rosettes of white plagioclase. Position suggests inverted topography of a canyon-filling lava. Maximum thickness is 9 meters (30 feet).

Tbtf — TUFF AND VOLCANICLASTIC SEDIMENTS — Brown basaltic tuff and volcaniclastic sediments. Minor beds of arkosic sand, pumice, and rhyolitic ash. Up to 107 meters (350 feet) thick.

Tbv — BASALT VOLCANIC ASSEMBLAGE — Contains several undivided lithologies: (1) thin subaerial lava flows, (2) thin subaqueous and other water-affected subaerial lava flows, and (3) tuff and volcaniclastic sediments. Lava up to 73 meters (240 feet) thick; overlying tuff and volcaniclastic sediments up to 61 meters (200 feet) thick.

Tbal — BASALT AND ANDESITE OF GRAVEYARD POINT AREA — Olivine basalt near Graveyard Point and pyroxene andesite breccia south of Graveyard Point (Ferns, 1989).

TERTIARY RHYOLITES

Tbf — RHYOLITE OF THE BOISE FRONT — Pinkish gray porphyritic rhyolite, dark gray vitrophyre, and gray perlite.

Tjc — JUMP CREEK RHYOLITE — Mostly gray porphyritic rhyolite and quartz latite. Plagioclase phenocrysts up to 15 millimeters. Lava flow or remobilized welded tuff.

Th — HORNBLENDE-BIOTITE RHYOLITE — Black glassy rhyolite; light gray where devitrified.

CRETACEOUS GRANITIC ROCKS

g — GRANITIC ROCKS OF THE IDAHO BATHOLITH — Light gray biotite granite and granodiorite. Medium to coarse grained and equigranular to porphyritic. Includes pegmatite zones and dikes of rhyolite and basalt.

MAP SYMBOLS

- Contact: approximately located; dashed where inferred
- Fault: approximately located; dashed where inferred; dotted where concealed; ball and bar on downthrown side
- Strike and dip of bedding
- Approximate upper limit of Bonneville Flood slack water
- Sand dune fields
- Basalt sampling site

Magnetic Polarities, K/Ar Ages, and $^{40}Ar/^{39}Ar$ Ages of Basalts

Rock Unit	Field Number	Polarity	Latitude	Longitude	Age (Ma) [1] potassium-argon [2] argon-argon
Basalt of Mores Creek	MC-1	N	43°31.52'	116°3.76'	0.107 0.012 [1]
Basalt of Gowen terrace	GT-4	N	43°31.33'	116°4.24'	0.572 0.210 [1]
Basalt of Kuna Butte (South Side)	SS	N	43°31.51'	116°32.03'	0.387 0.031 [2]
Basalt of Lucky Peak	LP-4	N	43°31.85'	116°3.66'	1.364 0.210 [1]*
Caldwell lava flow	CBR	R	43°41.31'	116°41.06'	0.799 0.095 [2]
Upper Deer Flat lava flow	UDF	R	43°30.29'	116°34.38'	0.922 0.184 [2]
Basalt of Fivemile Creek	30-3	N	43°32.67'	116°9.38'	0.974 0.098 [1]
Basalt of Fivemile Creek	FM1	N	43°30.27'	116°6.91'	
Basalt of Fivemile Creek	FM2	N	43°31.52'	116°4.45'	
Basalt of Hubbard surface	TCC-1	N	43°31.92'	116°20.20'	1.001 0.098 [1]
Mason Creek lava flow	MA	NF	43°33.72'	116°28.23'	1.231 0.123 [2]
Black Cat Road lava flow	BC	R	43°31.43'	116°27.15'	
East Nampa lava flow	NSS	R	43°36.23'	116°31.12'	1.165 0.125 [2]
Rawson Canal lava flow	RC	R	43°34.09'	116°27.12'	

Potassium-argon and argon-argon analyses provided by the Berkeley Geochronology Center, Institute of Human Origins, University of California, Berkeley, California. Magnetic polarity results from field fluxgate magnetometer using five samples per site.

* Stratigraphic relationships indicate the K-Ar age of the basalt of Lucky Peak is too old (Othberg and Burnham, 1990).

Pedogenic[1] clay and duripans[2] on terraces.

	Map Unit: Qbg, Qbgc, Qwlg[4]	Qwg, Qds	Qng	Qgg	Qag, Qdg[4], Qpdg	QTtg
CLAY (percent) 0						
CLAY (percent) 25						
CLAY (percent) 50						
DURIPAN (meters) 0						
DURIPAN (meters) 1						
DURIPAN (meters) 2						

Soil data adapted from Collett (1980), Priest and others (1972), and the University of Idaho Soil Characterization Laboratory.

Collett, R. A., 1980, Soil survey of Ada County area, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 327 p., 72 sheets, scale 1:20,000.

Priest, T. W., C. W. Case, J. F. Witty, R. K. Preece, Jr., G. A. Monroe, H. W. Biggerstaff, G. H. Logan, L. M. Rasmussen, and D. H. Webb, 1972, Soil survey of Canyon area, Idaho: U.S. Department of Agriculture, Soil Conservation Service, 118 p., 59 sheets, scale 1:20,000.

[1] Pedogenic refers to the physical and chemical soil-forming processes that act upon earth materials at the land surface.

[2] Duripans are white silica- and calcium carbonate-cemented hardpans commonly called caliche.

[3] The Bonneville Flood slack-water sediments that form the surface of Qwlg (gravel of Wilder terrace) bury a duripan about 0.5 meter thick that formed in the top of the gravel.

[4] The surface of Qdg (gravel of Deer Flat terrace) is buried by loess from near Lake Lowell to near Wilder. The thick duripan lies at depths of 1-4 meters (3-13 feet).

CORRELATION OF MAP UNITS

REFERENCES

Ferns, M.L., 1989, Geology and mineral resources map of the Graveyard Point quadrangle, Malheur County, Oregon, and Owyhee County, Idaho: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-54, scale 1:24,000.

Howard, K.A., J.W. Shervais, and E.H. McKee, 1982, Canyon-filling lavas and lava dams on the Boise River, Idaho, and their significance for evaluating downcutting during the last two million years, in Bill Bonnichsen and R.M. Breckenridge, eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 629-641.

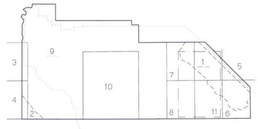
O'Connor, J.E., 1990, Hydrology, hydraulics, and sediment transport of Pleistocene Lake Bonneville flooding on the Snake River, Idaho: Tucson, University of Arizona Ph.D. dissertation, 192 p.

Pierce, K.L., and W.E. Scott, 1982, Pleistocene episodes of alluvial-gravel deposition, southeastern Idaho, in Bill Bonnichsen and R.M. Breckenridge, eds., Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin 26, p. 685-702.

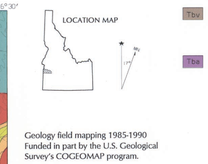
Savage, C.N., 1958, Geology and mineral resources of Ada and Canyon counties: Idaho Bureau of Mines and Geology County Report 3, 94 p.

Wood, S.H., and J.E. Anderson, 1981, Geology, in J.C. Mitchell, ed., Geothermal investigations in Idaho, Part 11: Geological, hydrological, geochemical, and geophysical investigations of the Nampa-Caldwell and adjacent areas, southwestern Idaho: Idaho Department of Water Resources, Water Information Bulletin 30, p. 9-31.

ADDITIONAL SOURCES OF GEOLOGIC MAPPING



1. Beck, C.C., 1989, Geological engineering maps of the Boise foothills, Ada County, Idaho: Slope, hydrology, soils, geology, and land-use hazards: Idaho Geological Survey Technical Report 89-2, 5 pl., scale 1:24,000.
2. Ekren, E.B., D.H. McIntyre, E.H. Bennett, and H.E. Malde, 1981, Geologic map of Owyhee County, Idaho, west of longitude 116o W.: U.S. Geological Survey Miscellaneous Investigations Series, Map I-1256, scale 1:125,000.
3. Ferns, M.L., 1989, Geology and mineral resources map of the Adrian quadrangle, Malheur County, Oregon, and Canyon and Owyhee counties, Idaho: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-56, scale 1:24,000.
4. Ferns, M.L., 1989, Geology and mineral resources map of the Graveyard Point quadrangle, Malheur County, Oregon, and Owyhee County, Idaho: Oregon Department of Geology and Mineral Industries, Geological Map Series GMS-54, scale 1:24,000.
5. Kiilsgaard, T.H., 1991, written communication–unpublished manuscript.
6. Othberg, K.L., and W.L. Burnham, 1991, Geologic map of the Lucky Peak quadrangle, Ada County, Idaho: Idaho Geological Survey Technical Report 90-4, scale 1:24,000.
7. Othberg, K.L., and Stanford L.R., 1991, Geologic map of the Eagle quadrangle, Ada County, Idaho: Idaho Geological Survey Technical Report 90-5, scale 1:24,000.
8. Othberg, K.L., L.R. Stanford, and W.L. Burnham, 1991, Geologic map of the Cloverdale quadrangle: Idaho Geological Survey Technical Report 90-6, scale 1:24,000.
9. Savage, C.N., 1958, Geology and mineral resources of Ada and Canyon counties: Idaho Bureau of Mines and Geology County Report 3, 94 p.
10. Wood, S.H., and J.E. Anderson, 1981, Geology, in J.C. Mitchell, ed., Geothermal investigations in Idaho, Part 11: Geological, hydrological, geochemical, and geophysical investigations of the Nampa-Caldwell and adjacent areas, southwestern Idaho: Idaho Department of Water Resources, Water Information Bulletin 30, p. 9-31.
11. Wood, S.H., and W.L. Burnham, 1983, Boise, Idaho, geothermal system: Transactions of the Geothermal Resources Council, v. 7, p. 215-225.



Geology field mapping 1985-1990
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SCALE 1:100,000
KILOMETERS 0 1 2 3 4 5
MILES 0 1 2 3
Contour Interval 40 Meters

U.S.G.S. 1:100,000 topographic base
Projection and 10,000 meter grid, zone 11, Universal Transverse Mercator
1927 North American Datum

Cartography by Loudon R. Stanford on a computer-aided cartographic system at the Idaho Geological Survey
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