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EXPLANATION

SEDIMENTARY AND METASEDIMENTARY ROCKS

CENOZOIC — QUATERNARY

Recent

Qs — Landslide and mudflow deposits
Predominantly landslide debris. Includes till-like mudflow deposits of andesitic rock fragments in clayey sand matrix in Buckley-Enumclaw area of King and Pierce Counties.

Qa — Alluvium
Mostly unconsolidated silt, sand, and gravel valley fill with some clay; includes low-level terrace, marsh, peat, artificial fill, and glacial deposits locally.

Qe — Eolian deposits
Active dune sand; includes beach sand along southwestern Washington coast.

Pleistocene

Qg_1, Qg_1t, Qg_1o — Younger glacial drift
Qg_1—*Younger glacial drift, undivided. Till, outwash, and associated deposits; sorted and unsorted sand, gravel, silt, and clay. Includes some alluvium.*
Qg_1t—*Till. Hard, blue-gray to gray concrete-like mixture of clay, silt, sand, and gravel deposited as end or recessional moraine. Principally Wisconsin in age.*
Qg_1o—*Advance and recessional outwash, stratified drift, and associated deposits. Primarily silt, sand, and gravel with some clay. Includes alluvium locally and scabland deposits of eastern Washington.*

Qgl — Glaciolacustrine deposits
Fine-grained sand and silt, well-stratified, with some gravel, clay, and diatomaceous earth. Contains clastic dikes in Walla Walla area.

Qg — Glacial drift, undivided
Glacial and glaciofluvial sand, gravel, and till; includes alpine glacier outwash and till as well as some Recent alluvium.

Qg_2 — Older glacial drift
Till, outwash, and associated interglacial deposits; sorted and unsorted gravel, sand, silt, and clay. Includes peat beds and nonglacial sediments locally. Mostly pre-Wisconsin in age.

Qc, Qce, Qcl — Quaternary nonmarine deposits
Mostly early and middle Pleistocene.
Qc—*Predominantly a well-cemented heterogeneous mixture of volcanic gravel, sand, silt, and clay. Contains some till and in western Washington is commonly deeply weathered.*
Qce—*Periglacial eolian deposits. Buff to light-brown, massive, homogeneous; unconsolidated loessial silt; some water-laid material locally. Probably early Pleistocene.*
Qcl—*Periglacial lacustrine deposits. Light-brown, well-sorted and bedded clayey sandstone and sandy clay with interbeds of volcanic ash and calcareous cemented gravels.*

Qt — Terrace deposits
Unconsolidated to partly consolidated fluvial and glaciofluvial sand and gravel with minor amounts of silt and clay. Includes marine terrace along west coast of the Olympic Peninsula.

TERTIARY

Pliocene

P — Pliocene marine rocks
Coarse conglomerate, shale, and minor sandstone; along ocean beaches in Grays Harbor County.

Pc — Pliocene nonmarine rocks
Conglomerate, sandstone, shale, and mudstone. Tuffaceous in part; contains alluvial fan type material locally.

Miocene

MP — Miocene-Pliocene marine rocks
Brown-gray, coarse-grained, moderately consolidated, commonly cross-bedded sandstone. Grades locally into gritstone and conglomerate lenses; includes minor shale beds; sandstone often shaly and in some areas grades into claystone.

MPc — Miocene-Pliocene nonmarine rocks
Tuffaceous and pumiceous andesitic sandstone and siltstone with interbedded conglomerate and claystone. Conglomerate beds chiefly andesitic, but also quartzitic, granitic, and basaltic; includes basalt flows locally.

M — Miocene marine rocks
Massive to thin-bedded, friable, basaltic to feldspathic sandstone, with shale, siltstone, and local pebble conglomerate interbeds.

Mc — Miocene nonmarine rocks
Poorly to moderately consolidated tuffaceous sandstone, conglomerate, siltstone, and claystone in western Washington. Chiefly clay and shale with minor sand, gravel, and diatomaceous earth near Spokane. Includes diatomite beds near Yakima and Quincy, and some marine beds in western Washington.

Oligocene

ΦM — Oligocene-Miocene marine rocks
Massive to thin-bedded, coarse-grained sandstone, conglomerate, conglomeratic sandstone, shale, and sandy shale.

Ts — Tertiary marine and nonmarine rocks
Predominantly light-gray to olive-gray, fine- to coarse-grained, thick-bedded sandstone with laminae to thick beds of medium dark gray siltstone, in northern Olympic Peninsula. Probably late Eocene to Miocene.

Tc — Tertiary nonmarine rocks, undivided
Sandstone, shale, conglomerate, agglomerate, and tuff; includes some lava flows. Massive conglomerate, sandstone, siltstone, and ferruginous shale in northwestern Whatcom County.

Φ — Oligocene marine rocks
Massive, tuffaceous and nontuffaceous sandstone and siltstone; locally concretionary; includes conglomerate along the north coast of Olympic Peninsula and basaltic sandstone east of Chehalis.

Φc — Oligocene nonmarine rocks
Andesite conglomerate, tuff beds, and mudflow material. Includes some interbedded andesite flows in Columbia River Gorge. Lake sediments with Oligocene flora in Republic area in Ferry County. Massive tuffaceous sandstone and siltstone with beds of coal and high-alumina clay in Castle Rock-Toledo coal district in Cowlitz and Lewis Counties; include local interbedded basalt flows and some marine and late Eocene rocks.

Eocene

E_1 — Upper upper Eocene nonmarine and marine rocks
Massive to thin-bedded, feldspathic to arkosic sandstone, siltstone, shale, and carbonaceous shale; becomes mostly nonmarine in the western foothills of Cascade Mountains where coal beds are abundant. Basaltic sandstone and siltstone in northern Olympic Peninsula.

E_2 — Lower upper Eocene marine and nonmarine rocks
Predominantly massive to well-bedded tuffaceous marine siltstone with interbedded arkosic and basaltic sandstone. Includes conglomerate in King County and along north side of Olympic Peninsula. Minor lava flows and breccia in western Lewis County and eastern Grays Harbor County. Coal seams in central Lewis County and north-central Pierce County.

pE_2 — Pre-upper Eocene rocks
Argillite and graywacke between inner and outer volcanic belts in Olympic Peninsula. Sheared carbonaceous argillite, argillite, graywacke, and minor conglomerate lenses and altered lava flows in western Yakima County.

Ec — Eocene nonmarine rocks
Predominantly sandstone and shale. Includes some conglomerate in the Cle Elum area in Kittitas County. Contains extensive coal seams near Roslyn and carbonaceous shale and coal beds in White Pass area. Contains tuff beds in northwestern Ferry County.

Paleocene

MzT — Mesozoic-Tertiary marine rocks, undivided
Dark-gray, massive to poorly bedded graywacke of the interior Olympic Peninsula; commonly with interbedded slate, argillite, volcanic rocks, and minor arkosic sandstone. Includes rocks both older and younger than Ev_2, some of which may be Paleozoic.

TKc — Paleocene-Cretaceous nonmarine rocks
Brown-gray to light-gray, medium- to coarse-grained massive cross-bedded arkose with interbedded conglomerate and siltstone. Contains several coal seams in Whatcom County. Iron-rich laterite at base near Cle Elum and Blewett Pass in Kittitas and Chelan Counties.

MESOZOIC — CRETACEOUS

K, Ku, Kl — Cretaceous sedimentary rocks, mostly marine
K—*Cretaceous conglomerate, sandstone, shale, breccia, limestone, and gritstone in San Juan Islands.*
Ku—*Upper Cretaceous black siltstone, graywacke, and silica pebble conglomerate in western Okanogan County.*
Kl—*Lower Cretaceous greenish-gray massive arkosic sandstone and light-gray sandy shale in western Okanogan County. Includes phyllite in eastern Whatcom County.*

pT — Pre-Tertiary sedimentary and metasedimentary rocks, undivided
Graywacke, argillite, phyllite, chert, talc, and graphite schist; some faulted-in blocks of serpentinite and greenstone. Includes minor limestone on San Juan Island.

Kc — Cretaceous nonmarine rocks
Redbeds of thick-bedded sandstone, shale, and pebble conglomerate in upper Methow River area of Okanogan County.

JURASSIC

JK, JKs — Upper Jurassic-Lower Cretaceous sedimentary and volcanic rocks
JK—*Sedimentary and volcanic rocks, undivided. Graywacke, argillite, siltstone, slate, volcanic rocks, phyllite, greenschist, and greenstone.*
JKs—*Predominantly sedimentary rocks. Graywacke, argillite, and siltstone with some slate and phyllite; includes graywacke breccia and ribbon chert with minor local limestone lenses and basalt flows.*

J — Lower and Middle Jurassic marine rocks
Dark-gray, massive to thick-bedded, siliceous argillite, siltstone, and shale; includes minor graywacke and limestone. Confined to northwestern Whatcom County.

ŦJ — Upper Triassic and/or Lower Jurassic marine rocks
Conglomerate, gritstone, graywacke, and carbonaceous argillite of northwestern Whatcom County.

pJ, pJs — Pre-Middle Jurassic sedimentary and volcanic rocks
pJ—*Sedimentary and volcanic rocks, undivided. Graywacke, argillite, slate, greenstone, and spilitic volcanic rocks.*
pJs—*Predominantly sedimentary rocks. Graywacke, argillite, and slate; include minor marble, siltstone, arkose, conglomerate, ribbon chert, and volcanic rocks.*

TRIASSIC

Ŧ — Triassic sedimentary rocks, undivided
Predominantly limestone, marble, and dolomite near Riverside in Okanogan County. Conglomerate, shale, graywacke, gritstone, and limestone on San Juan Island. Siltstone with greenstone locally on Orcas Island. Graywacke conglomerate, cherty greenstone, and limestone in northern Ferry County

PALEOZOIC — PERMIAN

P — Permian rocks
Conglomerate, graywacke, siltstone, argillite and interbedded fossiliferous limestone, greenstone, and minor angular conglomerate in northwestern Stevens and Ferry Counties. Impure quartzite, sandstone, graywacke, greenstone, ribbon chert, chert breccia, and limestone in Snohomish County and on San Juan Island. Lower Permian limestone on Black Mountain in northwestern Whatcom County. Middle Permian rocks in northeastern Washington.

CP, CPs — Carboniferous-Permian sedimentary and volcanic rocks
CP—*Sedimentary and volcanic rocks, undivided. Cherty and slaty argillite, siltstone, graywacke, chert, greenstone, tuff, andesite, and spilitic volcanics.*
CPs—*Predominantly sedimentary rocks. Graywacke, argillite, and slate; includes minor marble, siltstone, arkose, conglomerate, ribbon cherts, and volcanic rocks. Some Devonian rocks may be included in northwestern Washington.*

Pu — Upper Paleozoic rocks, undivided
Mostly graywacke, interbedded quartzite and phyllite, greenstone and serpentine, and black shale with minor limestone. Some quartz-mica schist in Bald Knob area of Ferry County. Schist, gneiss, and amphibolite in other parts of Ferry County. Some rocks of lower Paleozoic age, possibly Precambrian, and Mesozoic may be included.

CARBONIFEROUS

C — Carboniferous rocks
Thin-bedded graywacke, shale, argillite, slate, schist, volcanic breccia, gritstone, conglomerate, and limestone on northeast shore of Orcas Island. Limestone or dolomitic limestone, apparently interbedded with limy argillite and graywacke, forms belt of small separate outcrops between Springdale and Valley in southeastern Stevens County. Late Devonian to Early Pennsylvanian in age.

DEVONIAN

D — Devonian rocks
Thin alternating beds of cherty quartzite and argillite, occasional limestone lenses, volcanic rocks, sandstone, and graywacke on northwest shore of Orcas Island. Small outcrops of Devonian limestone included under Pu in southeastern Stevens County and under CPs in northwestern Whatcom County.

SILURIAN AND DEVONIAN

SD — Silurian-Devonian rocks
Mainly black argillite; some limestone, thin beds of conglomerate, sandstone, quartzite, and dolomite. Rocks confined to northwestern Pend Oreille County and adjacent Stevens County. Silurian age based on Monograptus and corals of several unusual genera; Devonian age based on coral fauna.

ORDOVICIAN

O — Ordovician rocks
Mainly black to gray slate or slaty argillite, argillite, black to dark-gray limestone, and some black to gray quartzite. Includes dark-gray siltstone in north-central Stevens County and grayish olive-green silty argillite in west-central Stevens County. Many occurrences of Early and Middle Ordovician graptolites; also rare conodonts.

CAMBRIAN

Cls — Cambrian limestone and dolomite
Mostly massive dolomite, with a basal unit of gray to dark-gray limestone interbedded with limy shale, and an upper unit of fine-grained massive limestone with some marble; Pend Oreille and northern and central Stevens Counties. Three-fold division less evident in Colville area. Dolomite, with minor basal unit of interbedded limestone and phyllite in the Addy-Dunn Mountain area of Stevens County. Marble, dolomite, limestone, and limy slate in Hunters district. Dolomitic marble in southern Stevens and northern Lincoln Counties. Middle Cambrian fossils near base in Metaline district, and Bathyuriscus-Elrathina fauna in lower unit in Leadpoint district. Phosphatic brachiopods in upper unit in Leadpoint district tentatively assigned to Middle and Upper Cambrian.

Pl — Lower Paleozoic rocks, undivided
Predominantly gneiss and schist in northern Ferry County. Quartzite, partly interbedded with dolomitic and calcitic marble, lime-silicate gneiss, and amphibolite; including in places forsterite marble and diopside marble, quartz-biotite-sillimanite schist and sillimanite-orthoclase gneiss in northeastern Ferry County. Quartzite with overlying limestone in southeastern Stevens County. Some upper Paleozoic and Precambrian rocks may be included.

Cph — Cambrian phyllite
Predominantly gray-green, banded phyllite, some sericite schist, abundant thin beds of quartzite, especially in lower part of unit, and limestone in upper part; northern Pend Oreille County. Much the same lithology but more conspicuous subunits of quartzite, limestone, and schist in northeastern Stevens County. Gray phyllite, greenish argillite, andalusite schist, minor interbedded quartzite and siliceous dolomite, especially in lower part, and much gray limestone in upper part; north-central Stevens County. Limestone bed in lower part of unit contains Lower Cambrian fossils (Archaeocyathus).

Cq — Cambrian quartzite
Gritstone with conglomerate in lower part and gray, white, and buff platy quartzite in upper part grading upward into phyllite; northern Pend Oreille County. Light-gray, platy, medium- to thick-bedded quartzite in upper part and darker impure quartzite with some interbedded argillite or phyllite in lower part; north-central Stevens County. White, gray, and reddish, medium- to thick-bedded quartzite in lower part and thin interbeds of quartzite and argillite in upper part, with very low Lower Cambrian fossils (Nevadia, Hyolithellus, and three genera of brachiopods) near base of upper part; Addy district of central Stevens County. Thick argillite and thin quartzite units form an uppermost zone in southwestern Stevens County. Conspicuous phyllite units near base in north-central Lincoln County.

PRE-CAMBRIAN (?)

pCph — Precambrian (?) phyllite
Mostly phyllite with interbedded carbonate rocks, quartzite, and gritstone; some tufflike beds and conglomerate at the base. Rocks confined to northeastern Pend Oreille County and central Stevens County.

PRECAMBRIAN

pCc — Precambrian conglomerate
Gray-brown, coarse, poorly sorted pebbles and cobbles of limestone, dolomite, reddish-brown quartzite, black slate or phyllite, and rarely granitic rocks in a gray sandy phyllite matrix; northeastern Pend Oreille County and southwestern Stevens County. Rocks become finer grained and more schistose and the unit becomes thicker toward the southwest, where there is included an isolated subunit which may be a tillite, consisting of cobbles, boulders, and blocks of argillite and carbonate rocks in a fine silty matrix.

UNCONFORMITY

pC, pCd — Precambrian rocks, undivided
Predominantly phyllite with some schist, limestone, dolomite, quartzite, and volcanic rocks; northeastern Pend Oreille County. Mainly quartzitic sandstone in upper part, dark-gray argillite with sandstone and limestone in middle part, and sandstone with argillite in lower part; southeastern Pend Oreille County. Banded slate with quartzite and dolomite; magnesite-bearing Stensgar dolomite shown as pCd; southwestern Stevens County. Quartzite, siliceous argillite, and argillaceous quartzite grading into argillite and quartz-mica schist from south to north; southeastern Stevens County. Quartzite, argillite, quartz-feldspar gneiss, and other metamorphic rocks in northeastern Whitman and southeastern Spokane Counties are partly if not all extensions of the Belt strata.

EXTRUSIVE IGNEOUS ROCKS

Qv — Pleistocene-Recent volcanic rocks
Predominantly dark-gray to black vesicular basalt; olivine-rich in part. Includes andesite flows and pyroclastic rocks of Mount Baker, Glacier Peak, Mount Rainier, Mount Adams, Mount St. Helens, and all cinder cones in southern part of the State. Also includes some Recent flows southeast of Mount St. Helens.

PQv — Pliocene-Pleistocene volcanic rocks
Light-gray andesite, andesite porphyry, and open-textured basalt flows with minor associated mudflows and breccia. Includes restricted areas of valley flow basalt in Snake River Canyon in southeastern Washington and in Spokane area.

MPv — Miocene-Pliocene volcanic rocks
Dark-gray, fine-grained, dense, porphyritic in part, basalt flows in central and south-central part of State; commonly interbedded with conglomerate, sandstone, and siltstone. Includes small areas of rhyolite north of Cle Elum in Kittitas County, and andesite north of Leavenworth in Chelan County.

Mv — Miocene volcanic rocks
Dark-gray to black, dense aphanitic basalt flows; commonly columnar jointed, less commonly irregularly and platy jointed; some flows vesicular, grading to scoriaceous; includes minor pillow lava, palagonite beds, and interbedded soil profiles and sedimentary beds; contains diatomite beds locally. Maximum thickness in south-central Washington may be in excess of 10,000 feet; much thinner in western Washington, where flows are mostly associated with marine sedimentary rocks. Includes acidic and intermediate volcanic rocks in northern Cascade Mountains.

ΦMv — Oligocene-Miocene volcanic rocks
Andesite flow breccia, andesite flows, and minor tuff beds; includes some basalt flows and flow breccia. Commonly more massive and less altered than similar-appearing Eocene-Oligocene volcanic rocks. Clastic flows and flows of black glass, and coarse- to fine-grained clastic and pyroclastic rocks in the Republic and Curlew areas of Ferry County.

Tv, uTv, lTv — Tertiary volcanic rocks, undivided
Tv—*Tertiary volcanic rocks, undivided. Includes andesite, basalt, and rhyolite flows, and associated pyroclastic rocks. In isolated areas across the northern part of State.*
uTv—*Upper Tertiary volcanic rocks, undivided. Mostly massive andesite flows, flow breccia, and pyroclastic material; includes some basalt flows and sedimentary rocks.*
lTv—*Lower Tertiary volcanic rocks, undivided. Predominantly andesite flows and flow breccia; includes basalt flows, minor rhyolite rocks, and some sedimentary rocks.*

Φv — Oligocene volcanic rocks
Andesite and rhyodacite flows, tuff, and tuffaceous sandstones of northern Lincoln County and southwestern Stevens County.

EΦv — Eocene-Oligocene volcanic rocks
Predominantly light-green, bedded andesite breccia with interbedded andesite and basalt flows, mudflows, and tuff beds; becomes more tuffaceous near top of unit. Includes tuffaceous and arkosic sandstone, shale, and carbonaceous shale beds in central and southern Cascade Mountains. Rhyodacite and quartz latite flows in northwestern Ferry County.

Ev_1, Ev_1a, Ev_1b, Ev_1r — Upper Eocene volcanic rocks
Ev_1—*Andesite and basalt flows and associated breccia in central Lewis County. Pyroclastic rocks, mudflows, flow breccia, and volcanic-rich sedimentary rocks in King and Pierce Counties.*
Ev_1a—*Predominantly andesite flows and breccia; includes some basalt flows. Contains basaltic conglomerate, pyroclastic rocks, tuff beds, and sandstone in Chehalis-Centralia coal district, Lewis County.*
Ev_1b—*Predominantly basalt flows and flow breccia; includes some pyroclastic and andesitic rocks. Chiefly in western Washington.*
Ev_1r—*Rhyolite flows and some interbedded tuff beds in Cle Elum area, Kittitas County.*

Ev — Eocene volcanic rocks
Predominantly andesite flows and breccia; includes interbedded sedimentary rocks south of Startup in Snohomish and King Counties.

Ev_2 — Middle and lower Eocene volcanic rocks
Dark-gray, coarse- to fine-grained, strongly chloritized basalt flows and breccia; includes pillow lava, deeply altered palagonite beds, amygdaloidal and vesicular flows, and, locally, sedimentary rocks. Comprises outer volcanic belt in Olympic Peninsula, where manganese ore is associated with some submarine lavas.

MzTv — Mesozoic-Tertiary volcanic rocks, undivided
Altered basalt, pillow lava, and flow breccia of inner volcanic belt of Olympic Peninsula; includes minor interbedded red limy argillite and associated manganese ore.

TKv — Upper Cretaceous-lower Tertiary volcanic rocks
Dark-gray to green andesite tuff, breccia, and flows in Methow River area of Okanogan County.

pTv — Pre-Tertiary volcanic rocks, undivided
Andesite and basalt flows, and greenstone; includes minor interbedded limestone, arkose, quartzite, and chert beds.

JKv — Upper Jurassic-Lower Cretaceous volcanic rocks
Predominantly volcanic rocks, mostly metamorphosed to greenstone and greenschist; includes some sedimentary rocks.

Mzv — Mesozoic volcanic rocks, undivided
Includes latite, andesite and basalt flows, tuff, and agglomerate. Interbedded sedimentary rocks in Orient area of Stevens County.

Jv — Middle Jurassic volcanic rocks
Andesite, dacite, and minor basalt with slate and graywacke interbeds in the Nooksack River region of Whatcom County.

pJv — Pre-Middle Jurassic volcanic rocks, undivided
Predominantly greenstone and spilitic volcanic rocks; includes some slate, argillite, and graywacke.

CPv — Carboniferous and Permian volcanic rocks
Predominantly altered andesite, basalt, and diabase with interbedded chert and argillite; includes some tuff, greenstone, and spilitic volcanic rocks; northern Cascade Mountains. Mostly schistose greenstone, some agglomerate, and rarely lapilli; includes minor beds of limestone with associated argillite and graywacke; northwestern Stevens County.

pCv — Precambrian volcanic rocks
Mostly homogeneous schistose greenstone; in places massive, mottled, and containing conspicuous calcite and epidote. Tuffaceous chlorite schist in upper part in northern Pend Oreille County. Amphibolite and plagioclase amphibolite in Little Pend Oreille Lakes district. Massive to sheared or schistose greenstone with dark-green ovoid spots; agglomeratic and amygdaloidal in places; sheared pillows near Blue Creek, central Stevens County; minor intrusive phase and probable center of eruption west of Finch magnesite quarry; central to southwestern Stevens County.

MAP SYMBOLS

Contact
Known, approximate, and inferred are undifferentiated.

Scratch boundary
Contact uncertain, or edge of specific mapped area.

Fault
Character not designated; dashed where approximately located.

Concealed fault

Thrust fault
Saw-teeth on upper plate.

Border of continental ice sheet
Sources of data for border are 9,41,112a, 112gg, 114 (see data list).

METAMORPHIC AND INTRUSIVE IGNEOUS ROCKS

Ti — Tertiary dikes, sills, and small intrusive bodies
Dikes are commonly diabase; plugs and sills are generally andesite porphyry and dacite.

Tg — Tertiary granitic rocks
Granite, quartz monzonite, quartz diorite, granodiorite, and trondhjemite. Includes dacite porphyry and granite breccia near Bumping Lake, Yakima County.

Tas — Tertiary alkali intrusive rocks
Syenite sills in Phalen Lake area, northwestern Stevens County. Porphyritic syenite in Danville area of Northern Ferry County.

Td — Tertiary dunite intrusive rocks
An intimate mixture of saxonite and dunite, partly serpentinized; Twin Sisters mountain area of Whatcom and Skagit Counties. Predominantly dunite and associated serpentinite in Jumbo Mountain area of central Snohomish County.

bi — Basic intrusive rocks, undivided
Predominantly gabbro; includes some serpentine. Age undetermined.

TKg — Tertiary-Cretaceous granitic intrusive rocks
Granite, granodiorite, trondhjemite, and quartz diorite. Late Cretaceous and/or early Tertiary.

TKbi — Tertiary-Cretaceous basic intrusive rocks
Diorite and gabbro in western Snohomish County.

pTm — Pre-Tertiary metamorphic rocks, undivided
Schist, gneiss, marble, quartzite, amphibolite, greenstone, metaconglomerate, graywacke; includes metasedimentary, volcanic, and intrusive rocks. Some areas, as on San Juan Islands, show little if any metamorphism.

pTbi — Pre-Tertiary basic intrusive rocks
Predominantly gabbro and metagabbro; includes hornblendite, peridotite, and pyroxenite. In Nighthawk district and near 49th Parallel in Okanogan County and in Orient district of Stevens County.

pTb — Pre-Tertiary ultrabasic intrusive rocks
Peridotite and pyroxenite; generally altered partly or completely to serpentine. Includes serpentinite and saxonite on Sumas Mountain, Whatcom County.

pTd — Pre-Tertiary dunite intrusive rocks
Dunite associated with serpentine on Cypress Island in San Juan Islands and on Mount Chopaka near Oroville in Okanogan County.

Mzg — Mesozoic granitic rocks, undivided
Granite, quartz monzonite, quartz diorite, granodiorite, and trondhjemite. Includes diorite in southeastern Washington; diorite and gabbro near Conconully in Okanogan County; gneiss, schist, and migmatites in areas of Chelan, Colville, and Okanogan batholiths. Includes high-grade metamorphic rocks of Precambrian age in Spokane area.

Mzag, Mzas — Mesozoic alkali intrusive rocks
Mzag—*Albite granite as small plugs and sills near Boundary in Stevens County.*
Mzas—*Syenite in Nighthawk and Buckhorn Mountain areas of Okanogan County; malignite on Kruger Mountain near Nighthawk.*

pJph, pJgs — Pre-Upper Jurassic metamorphic rocks of the low-grade zone
Greenschist, phyllite, and slate; includes some limestone, quartzose phyllite, schistose metaconglomerate, breccia, and basic igneous rocks. Includes schist locally. Greenschist of central Whatcom and Skagit Counties, pJgs.

pJsc — Pre-Upper Jurassic metamorphic rocks of the medium and high-grade zones
Schist, amphibolite, and minor lime-silicate rocks, marble, quartzite, and metaconglomerate.

pJgn — Pre-Upper Jurassic gneiss
Biotite, quartz diorite, trondhjemite, and hornblende gneisses, many of which are migmatitic; includes small granitic bodies locally. Small areas of mica schist, marble, amphibolite, and lime-silicate rocks in Entiat Mountains area of Chelan County.

pCg — Pre-Carboniferous intrusive rocks
Meta-quartz diorite, hypersthene diorite, and gneissose and directionless quartz diorite of eastern Skagit County. Quartz diorite and diorite in the San Juan Islands. Includes amphibolite and gneiss locally.

pCm — Pre-Carboniferous crystalline complex
Metahornblendite, amphibolite, gneiss, metadiorite, meta-quartz diorite, and trondhjemite. As klippes along western slope of northern Cascade Mountains.

pCi — Precambrian intrusive rocks
Dark-gray diorite sills from 3 to 1,200 feet thick. Confined to Bead Lake district, southeastern Pend Oreille County. Tentatively assigned to the Precambrian

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DESCRIBED FORMATIONS INCLUDED UNDER FOLLOWING UNITS

Only published descriptions are listed. Number before author's name refers to "Sources of Data" list.

SEDIMENTARY AND METASEDIMENTARY ROCKS

Formation	Region	Authority
Qs — Mudflow and landslide deposits		
Landslide debris	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
	Castle Rock-Toledo	85 Roberts, A. E.
	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
Osceola mudflow	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Qg_1 — Younger glacial drift, undivided		
Glacial deposits, undifferentiated	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Glacial drift	King County	111 Warren, W. C., and others
Ground moraine	Wilkeson	112a Bretz, J H.
Morainic deposits	Puget Sound	112q Weaver, C. E.
Terminal and recessional moraine	Wilkeson	112a Bretz, J H.
Vashon drift	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
	Wilkeson	112c Campbell, M. R., and others
	Wilkeson	112g Diller, J. S., and others
Vashon drift, modified	Tacoma	125 Willis, Bailey, and Smith, G. O.
Qg_1t — Younger glacial drift-till		
Glacial moraine deposits	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Ground-moraine deposits	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Vashon drift	Tacoma	125 Willis, Bailey, and Smith, G. O.
Vashon drift (till member)	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Kitsap County	89 Sceva, J. E.
	Western Snohomish County	78 Newcomb, R. C.
Vashon moraine	Yelm	75 Mundorff, M. J., and others
Vashon till	Yelm	75 Mundorff, M. J., and others
Qg_1o — Younger glacial drift—advance and recessional outwash, stratified drift, and associated deposits		
Deposits of the scabland	Southeastern Washington	101 Trimble, D. E.
	Southeastern Washington	46 Gard, L. M., Jr., and Waldron, H. H.
Gale sands	Tacoma	125 Willis, Bailey, and Smith, G. O.
Ice-contact stratified drift	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Midland sands	Tacoma	125 Willis, Bailey, and Smith, G. O.
Preglacial stratified drift	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Steilacoom gravels	Tacoma	125 Willis, Bailey, and Smith, G. O.
Vashon drift (outwash members)	Kitsap County	89 Sceva, J. E.
	Western Snohomish County	78 Newcomb, R. C.
	Yelm	75 Mundorff, M. J., and others
	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
Washtucna gravel	Southeastern Washington	46 Gard, L. M., Jr., and Waldron, H. H.
	Southeastern Washington	101 Trimble, D. E.
Qgl — Glaciolacustrine deposits		
Glacial silt deposits	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Lake deposits	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
Nespelem silt	Colville Ind. Res.	112k Pardee, J. T.
Qg — Glacial drift, undivided		
Alluvium and glaciofluvial deposits	Newport	90 Schroeder, M. C.
	Leadpoint	127 Yates, R. G., and Robertson, J. F.
	Stevens County	17 Campbell, Ian, and Loofbourow, J.S., Jr.
Alluvium, glacial, and fluvioglacial deposits	Oroville-Nighthawk	112n Umpleby, J. B.
Deep alluvium and glacial drift	Western Whatcom County	112d Crickmay, C. H.
Glacial deposits	Western Washington	112q Weaver, C. E.
Glacial deposits, undifferentiated	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Glacial drift	Colville Ind. Res.	112k Pardee, J. T.
	Eastern Washington	112b Bretz, J H.
	Stevens County	119 Weaver, C. E.
Glacial drift and alluvium	49th Parallel	112e Daly, R. A.
Glacial marine deposits	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Glacial material	Skagit and Whatcom Counties	112j Jenkins, O. P.
Glacial silt deposits	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Glaciofluvial deposits	Leadpoint	127 Yates, R. G., and Robertson, J. F.
	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
Glaciofluviatile deposits	Mount Rainier	22 Coombs, H. A.
Gravel of the Snake River	Southeastern Washington	46 Gard, L. M., Jr., and Waldron, H. H.
	Southeastern Washington	107 Waldron, H. H., and Gard, L. M., Jr.
Ground-moraine deposits	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Moraine deposits	Western Washington	112q Weaver, C. E.
Nespelem silt	Colville Ind. Res.	112k Pardee, J. T.
Quaternary	San Juan Islands	66 McLellan, R. D.
Till	Castle Rock-Toledo	85 Roberts, A. E.
Qg_2 — Older glacial drift		
Admiralty clay	Western Snohomish County	78 Newcomb, R. C.
Admiralty drift	Kitsap County	89 Sceva, J. E.
Admiralty till	Tacoma	125 Willis, Bailey, and Smith, G. O.
Intermediate glacial-drift sheets	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Orting gravel	Kitsap County	89 Sceva, J. E.
Preglacial stratified drift	Buckley	27 Crandell, D. R., and Gard, L. M., Jr.
Puyallup sand	Kitsap County	89 Sceva, J. E.
Stratified drift	Tacoma	125 Willis, Bailey, and Smith, G. O.
Qc — Quaternary nonmarine deposits, undivided		
Cowiche gravels	Yakima	94 Smith, G. O.
Logan Hill	Castle Rock-Toledo	85 Roberts, A. E.
	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Yelm	75 Mundorff, M. J., and others
Palouse	Eastern Washington	112b Bretz, J H.
Qce — Quaternary nonmarine deposits—periglacial eolian deposits		
Palouse	Chelan	114 Waters, A. C.
	Southeastern Washington	9 Bretz, J H., and others
	Southeastern Washington	46 Gard, L. M., Jr., and Waldron, H. H.
	Southeastern Washington	101 Trimble, D. E.
	Southeastern Washington	112b Bretz, J H.
	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Qcl — Quaternary nonmarine deposits—periglacial lacustrine deposits		
Lacustrine deposits	Vancouver	102 Trimble, D. E.
Older alluvium	Clark County	52 Griffin, W. C., and others
Qt — Terrace deposits		
Montesano series	Olympic Coast	112q Weaver, C. E.
Terrace deposits	Olympic Coast	112q Weaver, C. E.
	Castle Rock-Toledo	85 Roberts, A. E.
	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Pc — Pliocene nonmarine rocks		
Troutdale	Clark County	52 Griffin, W. C., and others
	Vancouver-Camas	103 Trimble, D. E.
MPc — Miocene-Pliocene nonmarine rocks		
Basalt conglomerate and undifferentiated members of the Ellensburg	Yakima	115 Waters, A. C.
Ellensburg	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
	Goldendale	115 Waters, A. C.
	Mount Stuart	95 Smith, G. O.
	Ellensburg-Yakima	94 Smith, G. O.
	Naches River	110 Warren, W. C.
	Toppenish	112c Campbell, M. R., and others
	Toppenish	112m Smith, G. O.
Pediment surfaces	Yakima	115 Waters, A. C.
Sediments below Wenas	Yakima	115 Waters, A. C.
M — Miocene marine rocks		
Astoria	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Southwestern Washington	54 Henriksen, D. A.
Astoria (?)	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Mc — Miocene nonmarine rocks		
Nonmarine sedimentary rocks	Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
Wilkes	Castle Rock-Toledo	85 Roberts, A. E.
ΦM — Oligocene-Miocene marine rocks		
Blakeley	Kitsap County	89 Sceva, J. E.
Sedimentary beds	King County	111 Warren, W. C., and others
Twin River (in part)	Northern Olympic Peninsula	10b Brown, R. D., Jr., and Gower, H. D.
Tc — Tertiary nonmarine rocks, undivided		
Conglomerate	49th Parallel, Ferry County	112e Daly, R. A.
Lake beds	Oroville	112o Umpleby, J. B.
Sedimentary rocks	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Sheep Creek	Stevens County	119 Weaver, C. E.
Tiger	Newport	90 Schroeder, M. C.
	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
Φ — Oligocene marine rocks		
Lincoln of Weaver	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Oligocene undifferentiated	Castle Rock-Vader	54 Henriksen, D. A.
Quimper sandstone	Quimper Peninsula	32 Durham, J. W.
Toutle	Castle Rock-Toledo	85 Roberts, A. E.
Twin River (in part)	Northern Olympic Peninsula	10b Brown, R. D., Jr., and Gower, H. D.
Φc — Oligocene nonmarine rocks		
Gerome andesite of Weaver (1920) (in part)	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
E_1 — Upper upper Eocene nonmarine and marine rocks		
Cowlitz	Castle Rock-Toledo	85 Roberts, A. E.
Olequa Creek member of the Cowlitz	Castle Rock	54 Henriksen, D. A.
Puget	King County	111 Warren, W. C., and others
	Carbonado	27 Crandell, D. R., and Gard, L. M., Jr.
	Carbonado	125 Willis, Bailey, and Smith, G. O.
	Carbonado	112f Daniels, Joseph
Puget group	Black Diamond	112r Weaver, C. E.
Tejon	Wilkeson	112p Weaver, C. E.
Twin River (in part)	Northern Olympic Peninsula	10b Brown, R. D., Jr., and Gower, H. D.
Skookumchuck	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
E_2 — Lower upper Eocene marine and nonmarine rocks		
Cowlitz	King County coal field	111 Warren, W. C., and others
Cowlitz, Stillwater Creek member	Castle Rock	54 Henriksen, D. A.
Lyre	Olympic Peninsula	10a Brown, R. D., Jr., and others
	Quimper Peninsula	32 Durham, J. W.
McIntosh	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Ec — Eocene nonmarine rocks		
Manastash	Snoqualmie Pass	96 Smith, G. O., and Calkins, F. C.
Naches	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Snoqualmie Pass	37 Foster, R. J.
	Cle Elum	94 Smith, G. O.
Roslyn	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Cle Elum	94 Smith, G. O.
Roslyn arkose	Teanaway River	37 Foster, R. J.
MzT — Mesozoic-Tertiary marine rocks, undivided		
Metamorphic formations	Olympics	112q Weaver, C. E.
Tejon	Olympics	112q Weaver, C. E.
TKc — Paleocene-Cretaceous nonmarine rocks		
Chuckanut	San Juan Islands	66 McLellan, R. D.
	Western Whatcom County	112r Weaver, C. E.
	Northwestern Whatcom County	70 Misch, Peter
	Whatcom County	112d Crickmay, C. H.
Conglomerate-argillite series	Sultan Basin	18 Carithers, Ward, and Guard, A. K.
Eocene sandstone	Skagit and Whatcom Counties	112j Jenkins, O. P.
	Mount Vernon	112h Hobbs, S. W., and Pecora, W. T.
Guye	Snoqualmie Pass	37 Foster, R. J.
Pipestone Canyon	Methow	2 Barksdale, J. D.
Swauk	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Cle Elum	37 Foster, R. J.
K — Cretaceous sedimentary rocks, mostly marine, undivided		
Nanaimo	San Juan Islands	66 McLellan, R. D.
Spieden	San Juan Islands	66 McLellan, R. D.
Winthrop sandstone	Methow	2 Barksdale, J. D.
Ku — Upper Cretaceous sedimentary rocks, mostly marine		
Winthrop sandstone	Methow	2 Barksdale, J. D.
Kl — Lower Cretaceous sedimentary rocks, mostly marine		
Lower Cretaceous marine sediments	Eastern Whatcom County	70 Misch, Peter
Virginian Ridge formation	Methow	2 Barksdale, J. D.
pT — Pre-Tertiary sedimentary and metasedimentary rocks, undivided		
Denny	Snoqualmie Pass	37 Foster, R. J.
Leech River group	San Juan Islands	66 McLellan, R. D.
Metamorphics	Skagit and Whatcom Counties	112j Jenkins, O. P.
Metamorphosed sediments	Western Snohomish County	78 Newcomb, R. C.
Pre-Cretaceous, Pre-Cretaceous metamorphics, Metamorphic and igneous rocks	Northern Puget Sound	112r Weaver, C. E.
Pre-Tertiary sedimentary and intrusive rocks	Mount Vernon	112h Hobbs, S. W., and Pecora, W. T
Kc — Cretaceous nonmarine rocks		
Midnight Peak (in part)	Methow	2 Barksdale, J. D.
JK — Upper Jurassic-Lower Cretaceous sedimentary and volcanic rocks, undivided		
Leech River group	San Juan Islands	66 McLellan, R. D.
JKs — Upper Jurassic-Lower Cretaceous sedimentary and volcanic rocks, predominantly sedimentary rocks		
Leech River group	San Juan Islands	66 McLellan, R. D.
Newby	Methow	2 Barksdale, J. D.
Nooksack group	Northern Cascades	70 Misch, Peter
Old metamorphic series	Sultan Basin	18 Carithers, Ward, and Guard, A. K.
Ŧ — Triassic sedimentary rocks, undivided		
Haro	San Juan Islands	66 McLellan, R. D.
Limestone	Riverside	117 Waters, A. C., and Krauskopf, Konrad
P — Permian rocks		
Mission argillite	Northern Stevens County	119 Weaver, C. E.
Orcas group	San Juan Islands	66 McLellan, R. D.
Rossland volcanic group	Northern Stevens County	119 Weaver, C. E.
CP — Carboniferous-Permian sedimentary and volcanic rocks, undivided		
Ancient sediments	Northern Cascades	70 Misch, Peter
Pu — Upper Paleozoic rocks, undivided		
Colville quartzite	Stevens County	119 Weaver, C. E.
Covada group	Okanogan and Ferry Counties	112k Pardee, J. T.
Mission argillite	Stevens County	119 Weaver, C. E.
Undifferentiated argillite	Stevens County	119 Weaver, C. E.
C — Carboniferous rocks		
Chewelah argillite (in part)	Chewelah	119 Weaver, C. E.
Old Dominion (in part)	Chewelah	119 Weaver, C. E.
Leech River group	San Juan Islands	66 McLellan, R. D.
SD — Silurian-Devonian rocks		
Unnamed limestone Ledbetter slate (in part)	Metaline Falls	82 Park, C. F., Jr., and Cannon, R. S., Jr.
O — Ordovician rocks		
Ledbetter slate	Leadpoint	127 Yates, R. G., and Robertson, J. F.
	Metaline Falls	82 Park, C. F., Jr., and Cannon, R. S., Jr.
	Northeast Stevens County	15 Campbell, C. D.
Mission argillite (in part)	Kettle Falls-Rice, and Colville	119 Weaver, C. E.
Cls — Cambrian limestone and dolomite		
Clugston Creek limestone (in part)	Colville district	119 Weaver, C. E.
Limestone	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Metaline limestone	Leadpoint	127 Yates, R. G., and Robertson, J. F.
	Metaline Falls	82 Park, C. F., Jr., and Cannon, R. S., Jr.
	Northeast Stevens County	15 Campbell, C. D.
Northport limestone	Northern Stevens County	119 Weaver, C. E.
Old Dominion limestone (in part)	Colville district	119 Weaver, C. E.
Undifferentiated limestone	Southwest Stevens County and south of Kettle Falls	119 Weaver, C. E.
Cph — Cambrian phyllite		
Colville quartzite (in part)	Colville	119 Weaver, C. E.
Clugston limestone (in part)	Colville	119 Weaver, C. E.
Maitlen phyllite	Leadpoint	127 Yates, R. G., and Robertson, J. F.
	Metaline Falls	82 Park, C. F., Jr., and Cannon, R. S., Jr
	Northeast Stevens County	15 Campbell, C. D.
Chewelah argillite (in part)	Colville and Chewelah	119 Weaver, C. E.
Cq — Cambrian quartzite		
Addy quartzite	Chewelah	17 Campbell, Ian, and Loofbourow, J. S., Jr.
Colville quartzite	Colville	119 Weaver, C. E.
Gypsy quartzite	Metaline Falls	82 Park, C. F., Jr., and Cannon, R. S., Jr.
	Northeast Stevens County	15 Campbell, C. D.
Quartzite	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Undifferentiated quartzite	Colville	119 Weaver, C. E.
Pl — Lower Paleozoic rocks, undivided		
Eagle Mountain quartzite	Chewelah	119 Weaver, C. E.
Grand Forks schists	49th Parallel, Ferry County	112e Daly, R. A.
Undifferentiated limestone (in part)	Chewelah	119 Weaver, C. E.
pCph — Precambrian (?) phyllite		
Colville quartzite (in part)	Addy	119 Weaver, C. E.
Monk	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
pCc — Precambrian conglomerate		
Huckleberry conglomerate	Chewelah	17 Campbell, Ian, and Loofbourow, J. S., Jr.
Shedroof conglomerate	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
pC — Precambrian rocks, undivided		
Bead Lake	Newport	90 Schroeder, M. C.
Deer Trail group	Chewelah	17 Campbell, Ian, and Loofbourow, J.S., Jr.
Edna dolomite of Campbell and Loofbourow	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
McHale slate of Campbell and Loofbourow	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
No Name argillite	Newport	90 Schroeder, M. C.
Priest River group	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
Skookum	Newport	90 Schroeder, M. C.
Togo formation of Campbell and Loofbourow	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
pCd — Stensgar dolomite		
Stensgar dolomite	Chewelah	17 Campbell, Ian, and Loofbourow, J. S., Jr.

EXTRUSIVE IGNEOUS ROCKS

Formation	Region	Authority
Qv — Pleistocene-Recent volcanic rocks		
Columbia lavas	Central Washington	112l Russell, I. C.
Midway volcanic group	49th Parallel, Okanogan County	112e Daly, R. A.
Mt. Baker volcanics	Northern Cascades	70 Misch, Peter
	Northern Cascades	23 Coombs, H. A.
Mt. Rainier volcanics	Mt. Rainier National Park	22 Coombs, H. A.
PQv — Pliocene-Pleistocene volcanic rocks		
Basalt (intracanyon)	Southeast Washington	101 Trimble, D. E.
	Southeast Washington	46 Gard, L. M., Jr., and Waldron, H. H.
	Southeast Washington	107 Waldron, H. H., and Gard, L. M., Jr.
	Southeast Washington	108 Waldron, H. H., and Gard, L. M., Jr.
Boring	Vancouver-Camas	103 Trimble, D. E.
	Clark County	52 Griffin, W. C., and others
Intercanyon lava	Clarkston	61 Lupher, R. L., and Warren, W. C.
Tieton andesite	Tieton River	110 Warren, W. C.
	Naches	94 Smith, G. O.
MPv — Miocene-Pliocene volcanic rocks		
Columbia lavas	Central Washington	112l Russell, I. C.
Howson andesite	Cle Elum	37 Foster, R. J.
Post-Roslyn rhyolite	Teanaway River	37 Foster, R. J.
Rhyolite	Cle Elum	94 Smith, G. O.
Wenas	Yakima	94 Smith, G. O.
Wenas flow	Yakima	115 Waters, A. C.
Mv — Miocene volcanic rocks		
Astoria formation	Castle Rock-Vader	54 Henriksen, D. A.
Astoria (?) (basalt members)	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Basalt	Colville Ind. Res.	112k Pardee, J. T.
Columbia lavas	Central Washington	112l Russell, I. C.
Columbia River (?) basalt	Chehalis-Centralia	97 Snavely, P. D., Jr., and others
Columbia River basalt	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
	Southeast Washington	46 Gard, L. M., Jr., and Waldron, H. H.
	Southeast Washington	107 Waldron, H. H., and Gard, L. M., Jr.
	Southeast Washington	108 Waldron, H. H., and Gard, L. M., Jr.
	Southeast Washington	101 Trimble, D. E.
	Southeast Clark County	52 Griffin, W. C., and others
	South-central Washington	115 Waters, A. C.
Hannegan volcanics	Northern Cascades	70 Misch, Peter
Volcanic rocks	Castle Rock-Toledo	85 Roberts, A. E.
Yakima basalt	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Cle Elum	94 Smith, G. O.
	Yakima	115 Waters, A. C.
	Ellensburg-Yakima	94 Smith, G. O.
	Tieton River-Naches River	110 Warren, W. C.
	Toppenish	112c Campbell, M. R., and others
	Toppenish	112m Smith, G. O.
ΦMv — Oligocene-Miocene volcanic rocks		
Fifes Peak andesite	Tieton River-Naches River	110 Warren, W. C.
Taneum andesite	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Cle Elum	94 Smith, G. O.
	Tieton River-Naches River	110 Warren, W. C.
Tv — Tertiary volcanic rocks, undivided		
Andesite, basalt, porphyry	Colville Ind. Res.	112k Pardee, J. T.
Andesite flows and pyroclastics	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Hornblende andesite	Oroville	112n Umpleby, J. B.
Pend Oreille andesite	Newport	90 Schroeder, M. C.
Spilite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
lTv — Lower Tertiary volcanic rocks, undivided		
Mt. Catherine rhyolite	Snoqualmie Pass	37 Foster, R. J.
Silver Pass volcanic rocks	Easton	37 Foster, R. J.
Φv — Oligocene volcanic rocks		
Gerome andesite	Central Stevens County	17 Campbell, Ian, and Loofbourow, J. S., Jr.
Gerome andesite of Weaver (1920) (in part)	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Tertiary andesite	Colville Ind. Res.	112k Pardee, J. T.
EΦv — Eocene-Oligocene volcanic rocks		
Enumclaw	Black Diamond	112q Weaver, C. E.
Keechelus	Black Diamond	112r Weaver, C. E.
Keechelus andesite	King County coal field	111 Warren, W. C., and others
	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Snoqualmie Pass	37 Foster, R. J.
Keechelus andesite (lower part)	Mount Aix	110 Warren, W. C.
Keechelus andesite, undifferentiated	Mount Aix	110 Warren, W. C.
Lava flows	White and Green Rivers	112c Campbell, M. R., and others
	White and Green Rivers	112g Diller, J. S., and others
Miocene andesite	Wilkeson	112p Weaver, C. E.
Pyroxene andesite	Carbonado	112f Daniels, Joseph
Ev_1a — Upper Eocene volcanic rocks, Predominantly andesite flows and breccia		
Eocene volcanic series	King County coal field	111 Warren, W. C., and others
Northcraft	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
	Castle Rock-Toledo	85 Roberts, A. E.
Pyroxene andesite	Carbonado	112f Daniels, Joseph
	Carbonado	125 Willis, Bailey, and Smith, G. O.
Ev_1b — Upper Eocene volcanic rocks, Predominantly basalt flows and flow breccia		
Goble volcanic member of the Cowlitz	Castle Rock	54 Henriksen, D. A.
Hatchet Mountain	Castle Rock-Toledo	85 Roberts, A. E.
Pe Ell volcanic member of the Cowlitz	Pe Ell	54 Henriksen, D. A.
Teanaway basalt	Cle Elum	96 Smith, G. O., and Calkins, F. C.
	Cle Elum	94 Smith, G. O.
	Cle Elum	37 Foster, R. J.
Ev_1r — Upper Eocene volcanic rocks, Rhyolite flows and some interbedded tuff beds		
Kachess rhyolite	Cle Elum	96 Smith, G. O., and Calkins, F. C.
Rhyolite in the Guye	Cle Elum	96 Smith, G. O., and Calkins, F. C.
Ev — Eocene volcanic rocks		
Tejon	North-central King County	112q Weaver, C. E.
Volcanic rocks	Western Snohomish County	78 Newcomb, R. C.
Ev_2 — Middle and lower Eocene volcanic rocks		
Basalt	Quimper Peninsula	32 Durham, J. W.
Crescent (?)	Elma-Pe Ell	84 Pease, M. H., Jr., and Hoover, Linn
Metchosin	Eastern Willapa Hills	54 Henriksen, D. A.
Volcanic rocks	Kitsap County	89 Sceva, J. E.
TKv — Upper Cretaceous-lower Tertiary volcanic rocks		
Midnight Peak (in part)	Methow	2 Barksdale, J. D.
pTv — Pre-Tertiary volcanic rocks, undivided		
Eagle Cliff porphyrite	San Juan Islands	66 McLellan, R. D.
JKv — Upper Jurassic-Lower Cretaceous volcanic rocks		
Eagle Cliff porphyrite	San Juan Islands	66 McLellan, R. D.
Mzv — Mesozoic volcanic rocks, undivided		
Rossland volcanic formation	49th Parallel, Stevens County	112e Daly, R. A.
Rossland volcanic group	Northern Stevens County	112p Weaver, C. E.
CPv — Carboniferous and Permian volcanic rocks		
Ancient volcanics	Northern Cascades	70 Misch, Peter
pCv — Precambrian volcanic rocks		
Huckleberry greenstone	Chewelah	17 Campbell, Ian, and Loofbourow, J. S., Jr.
Leola volcanics	Ione	82 Park, C. F., Jr., and Cannon, R. S., Jr.

METAMORPHIC AND INTRUSIVE IGNEOUS ROCKS

Formation	Region	Authority
Ti — Tertiary dikes, sills, and small intrusive bodies		
Andesite porphyry	Tieton River	110 Warren, W. C.
	Mount Stuart	95 Smith, G. O.
Basic dikes	Mount Stuart	95 Smith, G. O.
Basic dikes and sheets	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Diabase	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Diorite	Colville Ind. Res.	112k Pardee, J. T.
Gerome andesite of Weaver (1920) (in part)	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Intrusive igneous rocks	Centralia-Chehalis	97 Snavely, P. D., Jr., and others
Pyroxene-diorite	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Tg — Tertiary granitic rocks		
Chilliwack granodiorite and quartz diorite	Northern Cascades	70 Misch, Peter
Diorite	Okanogan and Ferry Counties	112k Pardee, J. T.
Golden Horn granodiorite	Northern Cascades	70 Misch, Peter
Quartz diorite	Sultan Basin	18 Carithers, Ward, and Guard, A. K.
Silver Star granodiorite	East Clark County	52 Griffin, W. C., and others
	East Clark County and West Skamania County	34 Felts, W. M.
Snoqualmie granodiorite	King County	112q Weaver, C. E.
	Mount Aix	110 Warren, W. C.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
	Snoqualmie	37 Foster, R. J.
Td — Tertiary dunite intrusive rocks		
Peridotite	Sultan Basin	18 Carithers, Ward, and Guard, A. K.
Twin Sisters dunite	Northern Cascades	70 Misch, Peter
bi — Basic intrusive rocks, undivided		
Gabbro	Mount Stuart	95 Smith, G. O.
pTm — Pre-Tertiary metamorphic rocks, undivided		
Anarchist series	49th Parallel, Okanogan County	112e Daly, R. A.
Hornfels	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Limestone, marble, and phyllite	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Quartzite, schist, and greenstone	49th Parallel, Okanogan County	112o Umpleby, J. B.
Turtleback complex	San Juan Islands	66 McLellan, R. D.
Upper, Middle, and Lower Anarchist	Oroville	117 Waters, A. C., and Krauskopf, Konrad
pTbi — Pre-Tertiary basic intrusive rocks		
Ashnola gabbro	Okanogan County, 49th Parallel	112e Daly, R. A.
Basic complex	Okanogan County, 49th Parallel	112e Daly, R. A.
Gabbro	Oroville-Nighthawk	112o Umpleby, J. B.
Metagabbro and metadolorite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
pTb — Pre-Tertiary ultrabasic intrusive rocks		
Fidalgo group	San Juan Islands	66 McLellan, R. D.
Peridotite	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
pTd — Pre-Tertiary dunite intrusive rocks		
Fidalgo group (in part)	San Juan Islands	66 McLellan, R. D.
Mzg — Mesozoic granitic rocks, undivided		
Colville	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Colville batholith	Okanogan and Ferry Counties	112k Pardee, J. T.
Colville batholith facies III	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Gneiss; mylonitic, swirled, and porphyritic gneiss facies I and II	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Granite	Oroville-Nighthawk	112o Umpleby, J. B.
Kaniksu	Metaline	82 Park, C. F., Jr., and Cannon, R. S., Jr.
	Newport	90 Schroeder, M. C.
	Northeast Stevens County	15 Campbell, C. D.
Loon Lake granite	Chewelah	17 Campbell, Ian, and Loofbourow, J.S., Jr.
Mesozoic granite	Pend Oreille and Stevens Counties	112j Jenkins, O. P.
Mount Stuart granodiorite	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Osoyoos granodiorite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Quartz diorite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Rhyolite, Alaskite, Lamprophyre, Granite porphyry, Granodiorite, Quartz monzonite	Southern Stevens County	5 Becraft, G. E., and Weis, P. L.
Similkameen batholith	49th Parallel, Okanogan County	112e Daly, R. A.
Similkameen granodiorite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Turtleback complex	San Juan Islands	66 McLellan, R. D.
Whisky Mountain granodiorite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
Mzag — Mesozoic alkali intrusive rocks-albite granite		
Albite granite	Leadpoint	127 Yates, R. G., and Robertson, J. F.
Mzas — Mesozoic alkali intrusive rocks—syenite and malignite		
Granodiorite	49th Parallel, Okanogan County	112e Daly, R. A.
Hornblende syenite	49th Parallel, Okanogan County	112o Umpleby, J. B.
Kruger Mountain malignite	Oroville	117 Waters, A. C., and Krauskopf, Konrad
	Nighthawk	14 Campbell, C. D.
pJph — Pre-Upper Jurassic metamorphic rocks of the low-grade zone		
Anarchist series	Nighthawk	14 Campbell, C. D.
Ancient sediments	Northwestern Whatcom County	70 Misch, Peter
Easton schist	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
	Easton	37 Foster, R. J.
Hawkins	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Old metamorphic series	Sultan Basin	18 Carithers, Ward, and Guard, A. K.
Peshastin	Mount Stuart	95 Smith, G. O.
	Snoqualmie	96 Smith, G. O., and Calkins, F. C.
Shales, schists, quartzites, and greenstones	Oroville-Nighthawk	112o Umpleby, J. B.
pJsc — Pre-Upper Jurassic metamorphic rocks of the medium and high-grade zones		
Contact schist	Mount Stuart	95 Smith, G. O.
Granodioritic migmatites of Ruby Creek	Eastern Whatcom County	70 Misch, Peter
Leecher metamorphics	Methow	2 Barksdale, J. D.
pJgn — Pre-Upper Jurassic gneiss		
Methow gneiss	Methow	2 Barksdale, J. D.
Skagit gneiss	Northern Cascades	70 Misch, Peter
pCg — Pre-Carboniferous intrusive rocks		
Marblemount quartz diorite	Northern Cascades	70 Misch, Peter
pCi — Precambrian intrusive rocks		
Marshall diorite	Newport	90 Schroeder, M. C.
Precambrian greenstone (in part)	Chewelah	17 Campbell, Ian, and Loofbourow, J. S., Jr.

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