/* ------------------------ CODESET ------------------------ */
Title: Geologic map of the Tanana B-1 Quadrangle, central Alaska
Publication: RI 97-15A
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Title: Interpretive geologic bedrock map of the Tanana B-1 Quadrangle, central Alaska
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Title: Surficial geologic map of the Tanana B-1 Quadrangle, central Alaska
Publication: RI 97-15C
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Title: Derivative geologic materials map of the Tanana B-1 Quadrangle, central Alaska
Publication: RI 97-15D
URL: http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2554

Title: Derivative map of potential geologic hazards in the Tanana B-1 Quadrangle, Alaska
Publication: RI 97-15E
URL: http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2555
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I. Geologic Bedrock Units

Alluvial Deposits

Qaf: Alluvial fan deposits-Fan-shaped, heterogeneous mixtures of gravel with some sand and silt and few to numerous, subangular to rounded boulders, especially in proximal areas; may include debris- flow deposits; thick to thin bedded; surface smooth, except for numerous shallow, interconnected channels.

Qal: Alluvium in modern stream channels-Elongate deposits of stratified gravel and sand with few to numerous boulders beneath modern flood plains and associated low terraces; well sorted and medium to thick bedded, locally cross-bedded.

Qat2: Younger alluvial terrace deposits of lower Hunter, Hoosier, and Minook Creeks--Stratified pebble, cobble, gravel, and coarse sand forming elevated benches bordering modern flood plains with a maximum tread elevation of approximately 30 m above the modern streams; surface smooth, except for local low scarps; capped by up to 10 m primary and reworked eolian silt containing Pleistocene mammalian remains, including mammoth, sheep, horse and bison in the Hunter Creek area; plant remains and freshwater mollusk shells present in thin peat layers in the silt cap.

Qat1: Older alluvial terrace deposits of lower Minook Creek--Stratified pebble-cobble gravel and medium sand forming elevated benches bordering east side of lower Minook Creek with a maximum tread elevation of approximately 150 m above the present stream; surface smooth; capped by approximately 50 cm primary and reworked eolian silt.

Qfo: Old fan deposits of lower Chapman Creek-Fan-shaped, heterogeneous mixture of coarse gravel with some sand and silt and numerous rounded cobbles up to 40 cm in diameter; up to 6 m thick at distal parts and graded to a base level several meters higher than the present stream level;

surface thickly vegetated and mostly smooth with some relict stream channels and prominent ridges of cobble-gravel bar deposits aligned parallel to paleochannels.

Qfp: Floodplain alluvium bordering modern streams-Elongate deposits of stratified pebble-cobble gravel and medium sand with few to numerous boulders forming modern flood plains and associated low (~3 m) terraces; lower surfaces may be flooded during periods of maximum stream discharge; surface smooth except for local low scarps.

Qof: Outwash fan deposits-Fan-shaped, heterogeneous mixtures of washed pebble-cobble gravel with some sand and silt and numerous subangular to rounded boulders deposited by meltwater streams draining the margins of former glaciers; thin to thick bedded, locally cross-bedded and contain imbricate clasts; surface generally smooth and gently sloping, except for local low scarps and perched, abandoned paleodrainage channels.

QTg: High-level bench gravel--Stratified gravel, sand and silt, possibly of glaciofluvial origin, forming elevated benches in the northeastern part of the map area with a maximum tread elevation of approximately 430 m above the present streams; moderately to well sorted and medium to thick bedded, locally cross-bedded; clasts are well rounded and include boulders up to 2 m in diameter: commonly characterized by distinctive bright orange silt and clay filling interstices of tightly packed gravel and granule-pebble matrix; perennially frozen and up to at least 30 m thick (Mertie, 1937).

Colluvial Deposits

Qac: Undifferentiated alluvial and colluvial valley-fill deposits-Fan-shaped and elongate heterogeneous mixtures of subangular rock fragments and gravel with some silt and sand deposited in upper stream courses primarily by brief, intense summer stream flow, debris flows, and gelifluction; surface smooth, except for local low scarps and shallow, steep-sided channels. In the lower northwestern part of the map area the unit includes a considerable amount of reworked loess.

Qc: Undifferentiated colluvium-Irregular, heterogeneous blankets, aprons, and fans of angular to subrounded rock fragments, gravel, sand and silt that are left on slopes, slope bases, or high-level surfaces by residual weathering and complex mass-movement processes, including rolling, sliding, flowing, gelifluction, and frost creep; probably perennially frozen; locally washed by meltwater and slope runoff; surface generally reflects configuration of underlying bedrock surface.

Qca: Colluvial apron and fan deposits-Apron- and fan-shaped, heterogeneous mixtures of angular rock fragments with trace to some gravel, sand and silt deposited at the bases of steep walls of modern stream valleys; may include or be capped by a considerable amount of redeposited eolian silt; locally washed by meltwater and slope runoff; surface steep to gently sloping.

Qcs: Solifluction deposits-irregular drapes of poorly sorted mixtures of angular rock fragments of local origin, with trace to some sand and silt deposited on the upper slopes of Elephant Mountain primarily by solifluction and gelifluction; probably perennially frozen; surface gently to moderately sloping with prominent scallop-shaped ridges and lobes oriented approximately perpendicular to slope.

Qct: Talus deposits-Apron- and cone-shaped heterogeneous mixtures of angular rock fragments and trace to some gravel, sand, and silt deposited on steep slopes by snow avalanches, free fall, tumbling, rolling, and sliding; surface steep, slightly irregular, and covered with numerous angular rock fragments.

Qls: Landslide deposits4val to tongue-shaped heterogeneous mixtures of fractured bedrock and pebble-cobble gravel with trace to some sand and silt, deposited by near-surface to deep flowing and sliding due to slope failures in bedrock and unconsolidated surficial deposits; surface slightly irregular.

Eolian Deposits

Qer: Primary and reworked upland silt-Heterogeneous blankets of silt and organic silt originally laid down by eolian processes and subsequently extensively reworked by fluvial and colluvial processes; primary loess deposits occur as blankets of massive silt up to 20 m thick; reworked deposits probably perennially frozen and ice rich; primary deposits dry and generally ice free, but probably perennially frozen; surface smooth to locally gullied.

Qes: Dune sand deposits-Homogeneous blankets of medium to fine sand in longitudinal dunes deposited by wind along the banks of the Yukon River; surface is partially stabilized by vegetation and forms prominent elongate ridges up to 10 m high parallel to prevailing wind direction.

Glacial Deposits

Qd: Modified drift-Heterogeneous blankets of non-stratified pebble-cobble gravel with some sand and silt and few to numerous subangular to subrounded boulders deposited directly from glacial ice and modified by mass movement; weathering rinds of monzonite clasts up to 3 cm thick; surface smooth and rounded to gently hummocky with scattered rounded monzonite erratics up to 2.5 m in diameter; may be thickly mantled by angular colluvial debris, especially on lower valley walls.

Lacustrine Deposits

Ql: Undifferentiated lacustrine deposits-Arcuate or semicircular deposits of silt, sand and organic silt along margins of local small lakes and filling basins of shallow lakes; generally of thermokarst origin; saturated and locally frozen, locally ice rich; surface horizontal and smooth.

Man-made Deposits

Qh: Mine tailings-Water-washed pebble-cobble gravel with trace to some sand reworked by placer mining operations; moderate to well sorted; surface irregular or forming symmetrical ridges and cones.

Sedimentary and Igneous Rocks

Ts: Sedimentary rocks undivided (Weber and others, 1992; Eocene; Light yellowish brown, yellowish gray, and yellowish to reddish brown-weathering sandstone, siltstone and shale. Rocks

are generally poorly consolidated, calcite cemented, and commonly contain plant fossils and debris. Better exposures crop out 3 km northeast of the Tanana B-l Quadrangle on the Yukon River.

Tr: Rhyolite (early Eocene)-White and pink, purple and white, light-orange and pink, glassy-aphanitic to very fine grained, flow-banded rhyolite, rhyolite tuff breccia, ignimbrite, and potassium feldspar-porphyritic rhyolite. The rock types present suggest that the rhyolites were emplaced as flows, domes, tuffs, breccia, and rare obsidian, and suggest extrusion over a significant period of time. Felsic volcanic rocks locally weather to pastel-colored 'badland" topography. Compositions range from 66 to 80 percent silica and 150 to 300 ppm zirconium (Liss and others, 1997; Newberry and Haug, 1997) and show a well-defined bimodal relationship with the associated Tertiary basalt (Tb).

Tb: Basalt (Paleocene)-Very dark greenish gray, dark greenish brown-weathering, amygdaloidal, locally columnar jointed basalt. Locally copper stained, and locally contains minor sulfides including pyrite, chalcopyrite and arsenopyrite. Lack of extensive pillows suggests the basalts were primarily extruded in a subarea1 environment. Early Tertiary basalt ranges from 43 to 55 percent silica and 150 to 375 ppm zirconium and is tholeiitic and slightly alkalic, as indicated by alkali-silica data (Liss and others, 1997; Newberry and Haug, 1997).

Tsy: Quartz syenite dikes (Paleocene)-Medium gray to greenish gray, very fine grained equigranular to porphyritic, with 1 cm potassium feldspar tablets in a fine-grained ground mass, in which quartz, feldspar, and biotite predominate. Chemical analyses indicate these dikes range in composition from quartz syenite to syenogranite (Liss and others, 1997). These are hypabyssal dikes up to 2 m thick. Two 40Ar/39Ar age dates are 57.2 Ma (biotite) and 57.8 Ma (whole-rock) (table 1; Reifenstuhl and others, 1997).

Tdm: Mafic dikes (Paleocene)-Very dark gray and greenish very dark gray, very fine grained hypabyssal dikes. Composition is alkalic gabbro to monzodiorite, based on chemical analyses. Major minerals include biotite, clinopyroxene, and plagioclase. Thickness is typically less than 3 m. These mafic dikes are similar in major and minor element abundances to the Tertiary basalt (Liss and others, 1997; Newberry and Haug, 1997). Two 40Ar/3gAr whole-rock, age dates are 58 and 59 Ma (table 1; Reifenstuhl and others, 1997).

TKq: Quartz veins (Paleocene to Cretaceous)-Light gray to white, very fine grained, gold-bearing quartz veins with variable pyrite and chalcopyrite or arsenopyrite and rare muscovite selvages. The observed veins range from several centimeters to nearly 1 m thick. Quartz veins cross-cut several older units (described below) including the Rampart Group rocks, amphibolite facies metamorphic rocks, Cretaceous and Jurassic sedimentary rocks, and Cretaceous plutonic rocks. Two 40Ar/39Ar age dates (white mice) are 61 Ma and 72 Ma (table 1; Reifenstuhl and others, 1997).

Amphibolite Grade Rocks

PTam: Marble-White to light gray, medium- to coarse-grained, thin- to medium-bedded, typically finely laminated marble. Saccharoidal texture commonly developed. .Locally includes diopside-bearing, coarsely recrystallized marble and yellowish brown to orange-weathering dolomitic marble. Locally contains disseminated quartz clasts, thin quartzite interbeds, and broken quartz

veins. Apparent thickness ranges from several meters to 35 m, but the unit has been structurally thickened and its true thickness is unknown.

pTas: Medium- to coarse-grained schist and amphibolite-Gray to brown, red brown-weathering, medium- to coarse-crystalline, locally garnetiferous and staurolite-bearing, schist and green-black hornblende amphibolite. Diagnostic assemblages include garnet-staurolite-biotite-muscovite-quartzcalcic plagioclase-sillimanite-kyanite in pelitic rocks and hornblende-calcic plagioclase-quartz-magnetite in amphibolites. Garnets up to 1 cm in diameter characterize the metapelitic rocks in hand specimen. Preservation of earlier foliation in rotated garnets and distinctive compositional zonation in garnets indicates multiple periods of amphibolite-facies metamorphism.

pTaq: Quartzite-Light gray to medium gray, fine-grained, recrystallized sucrosic-textured, hard, dense, cryptically-layered quartzarenite interbedded with the pelitic schist unit. Exposures are rare and typically consist of blocky, black lichen-covered talus. Bedding is rarely seen and is about 10 cm thick. A black opaque mineral comprises up to 3 percent of the quartzite. Quartzite unit is uncommon and differentiated where possible.

Cretaceous and Jurassic Rocks

Kwc: *** Note: typographical errors exist on the Geologic Bedrock Map of the Tanana B-1 Quadrangle, Central Alaska (Publication RI97-15A-SH1) and the Interpretive Geologic Bedrock Map of the Tanana B-1 Quadrangle, Central Alaska (Publication RI97-15B-SH1). Unit Kws does not exist. Unit label should read Kwc. *** Wilber Creek unit (Albian)- Black to dark greenish gray sandstone, conglomerate, shale and siltstone containing laminae and thin interbeds of impure quartzwacke. Hornfels near intrusions commonly produce disoriented crystals or rosettes of muscovite and biotite. Contains abundant disseminated opaque material and accessory detrital tourmaline. Present only in small area overlying Elephant Mountain pluton in southeastern corner of map area.

Khs: Hornfelsed sedimentary rocks-Very dark gray to black, very fine- to fine-grained, hard, dense, hornfelsed sandstone and shale on the flank of Elephant Mountain pluton in the southeastern corner of map area. Commonly has disoriented crystals or rosettes of muscovite and biotite, and locally fine-grained andalusite.

KJwq: Wolverine quartzite unit (Early Cretaceous and (or) Jurassic)-Light gray to tan, white-weathering, moderately well-sorted, subrounded, fine- to medium-grained quartzarenite. Contains 2 to 5 percent altered chert clasts and light blue quartz clasts, 2 to 5 percent limonite spots, and forms resistant outcrops and blocky, typically black lichen-covered, talus. Bedding is rarely discernible, and quartzite appears massive (bioturbated?) in outcrops up to 30 m thick with local argillaceous partings. Sedimentary structures include local load casts and feeding traces (Nereites?).

KJws: Sandstone and shale undivided-Medium gray to light gray, locally black lichen-covered, quartz-rich sandstone and interbedded shale. Sandstone is tightly silica-cemented quartzarenite but lacks the prominent outcrop pattern and continuity of the quartzite unit (KJws). Sandstone is petrographically similar to the Wolverine quartzite unit: moderately well-sorted, subrounded, and with minor chert clasts.

Elephant Mountain Pluton

Kgs: Quartz syenite, granite, and granite pegmatite-Buff to light gray, medium- to coarse-grained, subequigranular holocrystalline rock. The rock exhibits varying degrees of hydrothermal alteration, with much of the feldspar and biotite converted to white mica. Alteration makes petrographic distinction between plagioclase and alkali feldspar impossible, but quartz versus quartz + total feldspar ratios vary from 10 to 30 percent, and the vast bulk of the feldspar appears to have been potassium feldspar.

Kms: Monzonite, syenite, and quartz syenite. Black- and white-peppered, coarse- to medium-grained, locally foliated, subequigranular to trachytoid, monzonite, syenite, and quartz syenite. With the exception of euhedral, megacrystic, alkali feldspar, the minerals are typically subhedral and anhedral. This unit contains 60 to 70 percent total feldspar, with alkali to plagioclase feldspar ratios of 1 :l to 2:l and quartz content typically between zero and 5 percent, rarely to 10 percent.

Kmzd: Monzodiorite, diorite, and monzonite-Black- and white-peppered, medium grained, subequigranular, alkalic plutonic rock lacking quartz and with more plagioclase than alkali feldspar. Mafic minerals (clinopyroxene>biotite>hornblende) commonly make up more than 50 percent of the rock. Hornblende in this rock is entirely deuteric, replacing early-formed clinopyroxene. Plagioclase exhibits a dusting of sericite; the other minerals are usually unaltered.

Kf: Felsic dikes-Light gray to greenish light gray, fine- to very fine-grained to aphanitic felsic, quartz-poor dikes up to 3 m thick. Dikes are typically altered and weathered to light greenish light gray, buff, and light orange buff, and contain abundant fine-grained white mica or clay minerals. No mafic minerals are present; ghost textures suggest that biotite and clinopyroxene were originally present but converted to white mica, rutile, pyrite, and carbonate.

Triassic to Permian Succession

TrPs: Sandstone and shale-Dark brownish gray to dark gray, fine- to medium-grained, locally carbonate- cemented lithic sandstone, and sandy to silty shale. Sandstone is thinly laminated to thin bedded, and has generally uniform grain size, and rare graded bedding and cross bedding. Rare sedimentary structures include load casts, burrows and bioturbation.

TrPa: Argillite. Dark gray to black, orange-weathering siliceous and locally carbonaceous argillite. Generally harder, more competent, and with a stronger fabric than the shale of the “sandstone and shale” unit above. Locally thinly laminated and fissile, and locally more massive or phyllitic. Rare zones with pyrite cubes to 2 mm. Locally contains chert layers; mapped separately where possible.

TrPv: Tuff-Pale green to medium greenish gray, and light greenish gray, very fine-grained to aphanitic, siliceous, limonite-stained, with reddish-brown leached pyrite pits, and rare malachite, chalcopyrite, and bornite. Occurs with cherty argillite as zones up to 10 m thick within layers of argillite and shales on ridges that flank Chapman Creek west of Elephant Mountain, where it is locally layered with a green andesitic sill. Some zones brecciated.

TrPl: Limestone (Early Permian to Triassic)-Reddish brown to brick red to yellowish brown, highly calcareous to limestone beds less than 1 m thick. Occurs in zones up to 60 m thick. Fossil

and lithic fragments and rounded pebbles stand out in relief on weathered surfaces. Contains fragments of shells of bryozoans, corals, crinoids, pelecypods, and brachiopods. Locally sheared and has pencil cleavage.

TrPc: Chert-Medium gray to light greenish gray, unfossiliferous, opalescent chert with concoidal fracture in poorly defined beds up to 10 cm thick. Contains no radiolarian ghosts and is undated. Chert is less than one percent of the total Triassic-Permian section, and is spatially associated with siliceous argillite. Geochemistry of chert (Haug and others, 1997) is distinctive relative to other chert units in the map area, and includes only minor overlap with the Rampart Group chert.

TrPp: Pebble conglomerate-Very dark gray, subrounded pebble- to cobble, clast-supported conglomerate. Clasts are 80 percent black, red, green, and dark-gray chert with minor quartzite, 10 to 15 percent light gray to white quartz, and 5 to 10 percent very dark gray argillite. Matrix is very dark gray argillite to very fine sand. Locally the conglomerate has a pronounced tectonically-induced stretch-pebble fabric.

Trd: Gabbro dike (Triassic)-Dark greenish dark gray, medium-grained, dark green-weathering gabbro dikes or sills, commonly covered by bright orange lichen. Gabbro crops out at one locality in the easternmost central map area. Thickness is about 15 m. The steeply-dipping west contact with the argillite unit is mylonitic and siliceous, and may be a faulted synclinal structure or a simple fault.

Rampart Group

TrMra: Argillite and chert-Very dark gray to black, fissile to phyllitic, nonfossiliferous argillite with variable amounts of gray, greenish gray, red, and white chert and cherty argillite. Chemical analyses (Haug and others, 1997) show that most of the rock mapped as chert is actually cherty argillite. Chert and cherty argillite comprise less than 10 percent of this argillite and chert unit.

TrMrb: Basalt-Very dark gray and dark greenish dark gray, very fine-grained, generally massive, but locally amygdaloidal or pillowed basalt. Distinguished with difficulty from fine-grained diabase sills on the basis of grain size, chilled margins, or chemistry; much of the rock mapped as Rampart Group basalt may be diabase. Unit is pervasively altered to fine-grained mixtures of chlorite, calcite, epidote, quartz, rutile, magnetite, and zeolite(?), with local remnant plagioclase ghosts.

TrMrg: Gabbro-Very dark gray and dark greenish dark gray, fine-grained hornblende-pyroxene gabbro and diabase which constitute the most abundant igneous rock in the Rampart Group. Hornblende occurs both as reaction rims surrounding clinopyroxene, and as isolated, interstitial (late magmatic?) grains. The characteristic texture is diabasic, with subhedral-altered pyroxenes and interstitial hornblende inter-grown with subhedral to euhedral former plagioclase grains.

TrMrs: Sedimentary rocks undivided-A diverse package of sedimentary and low-grade metasedimentary rocks including argillite, phyllite, chert, cherty argillite, graywacke, sandstone, and tuff(?), distinguished primarily by its proximity to Rampart Group gabbro. Argillite, phyllite, cherty argillite and graywacke are medium to dark gray to greenish gray. Cherts are light to dark gray, red, white, and greenish gray.

TrMrl: Limestone- Medium gray, impure limestone associated with gabbro or other Rampart Group lithologies; locally contains elastic component. Contains pelecypod shell prisms and bryozoan fragments of probable Permian age from nearby in the adjacent Livengood Quadrangle (Chapman and others, 1982). No fossils recovered in this study.

TrMru: Rampart Group undivided-Poorly exposed rocks of the Rampart Group; may include igneous and sedimentary rocks as discussed above.

Lower Paleozoic and Proterozoic Rocks (Livengood Dome Chert?)

Pzcla: Chert and cherty argillite-Heterogeneous unit composed dominantly of light gray to gray, finely laminated, recrystallized sericitic chert and siliceous argillite, commonly with phyllitic argillite partings; cherty argillite typically has cherty or mylonitic aspect on weathered surfaces, but fine-grained elastic or recrystallized texture on fresh surfaces. In places is distinctive cream-colored to mottled light- gray, fine-grained, even-grained, typically microfractured recrystallized chert that crops out poorly, forms coarse talus blocks 1 to 3 feet or more across, and produces "sandy powder" on freshly broken surfaces.

Pzlg: Graywacke and gritty quartz&-Dark gray, fine- to coarse-grained, poorly sorted to bimodal, subangular, quartz-plagioclase-chert graywacke. The quartz-plagioclase-chert ratio varies considerably, but quartz plus plagioclase is much greater than chert; contains rare grit-sized blue quartz "eyes," and numerous single-crystal sand-sized clasts in thin section.

Pzlv: Volcanic unit-Greenish-gray, chloritic and feldspathic rocks and greenstone derived from volcaniclastic, tuffaceous, and flow rocks of basaltic to intermediate composition; typically forms bold, jagged outcrops. Some rocks are diabasic and may be meta-intrusive rocks. The number of metavolcanic layers is uncertain, but some structural repetition by folding and ductile thrusting is interpreted from map patterns.

Pzll: Limestone-Light to medium gray, tan to reddish brown-weathering, extensively recrystallized, thin- to medium-bedded, lime mudstone containing floating quartz grains and distinctive coated grains and ooids in places. Unit locally is well-laminated, but is generally massive with bedding poorly developed or obscured by shearing. Contains chert nodules and stringers, minor dolomitization, and extensive silicification in places. Typical platy character resulting from well-developed axial planar fracture cleavage.

Amy Creek Unit

PzPad: Dolostone- White, generally massive-bedded to locally laminated, cherty dolostone; locally is slightly limy and contains coated ooids. Typically is extensively silicified and characterized by box-work silica; grades locally at top and bottom into medium gray limestone, and has subordinate interbeds of mylonitic siliceous argillite, greenstone, siltite, and minor dark gray chert. The northeastern end of outcrop belt along east edge of map contains two distinctive units.

PzPag: Greenstone-Dark greenish gray, massive to well-foliated, locally magnetic greenstone, amygdaloidal greenstone, and agglomeratic greenstone; basaltic to intermediate composition. Contains calcite amygdule fillings, locally abundant pyrite cubes, and slightly stretched volcanic

and carbonate clasts up to cobble size. Is associated with or interlayered within the Cherty-argillite and chert unit, and contains limestone pods or lenses up to 1 m thick locally.

PzPac: Cherty-argillite and chert-Heterogeneous unit of dominantly black to dark gray chert and siliceous to carbonaceous argillite with well-developed phyllitic to subphyllitic slaty cleavage, and containing one or more dark gray limestone layers or lenses. Yields geochemical signature typical of chert in the Amy Creek unit (based on 1 g-element discriminant analyses, Haug and others, 1997) of Weber and others (1988). Limestone up to 3 m thick locally crops out and is included in this unit.

Wickersham Unit

PzPws: Calcareous Siltstone and Sandstone- Distinctive medium gray, tan-weathering, thin-bedded, fine-grained, well-sorted siltstone and sandstone with up to 30 percent calcite recrystallized from, or replacing, matrix. These rocks contain abundant black, non-calcareous, carbonaceous, phyllitic argillite interbeds and partings; sandy layers and laminae are poorly sorted quartz-plagioclase wacke. Petrographically this unit is similar to the grit and quartzite unit (described below), indicating a genetic association.

PzPwg: Grit and quartzite-Quartz- and plagioclase-rich, poorly sorted to bimodal, subangular quartzite, gritty quartzite, and granule conglomerate containing sparse milky or blue quartz “eyes” and granules; light gray varieties have quartz-plagioclase-wacke matrix, and medium gray types are more argillaceous. For the coarsest fraction, quartz is generally much more abundant than plagioclase, and most quartz grains are single crystals; the matrix contains a relatively higher proportion of plagioclase and minor chert.

II. Derivative Geologic Materials Units

Unconsolidated Materials

GS: Fluvial and glaciofluvial gravel, sand, and silt. Chiefly (estimated >80 percent) clean sand and gravel. Grain size, sorting and degree of stratification are variable. Permafrost may be present, especially in older deposits.

GM: Poorly-to moderately well-sorted clay, silt, sand, gravel, and diamicton of colluvial and fluvial origins. Includes angular, unsorted talus debris and chaotically deformed colluvium derived from landslides. Engineering applications vary widely due to large range of grain size and sorting properties. Commonly frozen.

SM: Silt deposited primarily by wind and reworked by fluvial and colluvial processes. May be organic rich. Commonly frozen and ice-rich, especially on north-facing slopes. Chiefly fine materials. Estimated >80 percent silt, sand, and clay.

SA: Well sorted sand deposited by wind. Mostly thawed and dry. Chiefly (estimated 80 percent) sand. Includes primarily SW and SP of the Unified Soil Classification (Wagner, 1957).

Bedrock Materials

BC: Medium-jointed, fine to coarse grained sedimentary carbonate rocks and their metamorphic equivalents. Includes limestone, dolostone, and marble.

BG: Coarse-jointed, coarse-grained igneous lithologies. Chiefly granitic rocks.

BM: Medium-jointed, fine to coarse grained quartzose sedimentary rocks and their metamorphic equivalents. Includes quartzose sandstone and conglomerate, quartzite, chert, and hornfels.

BV: Medium-jointed, fine-grained igneous rocks and their metamorphic equivalents. Chiefly volcanic flow rock, dikes, and greenstone.

BU: Rocks of variable lithology and character that are generally unsuited for use as construction materials.