/* ------------------------ CODESET ------------------------ */
**Title: Bedrock geologic map of the Chulitna region, southcentral Alaska**
**Publication: RI 2001-1A**
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**Title: Geologic map of the Chulitna region, southcentral Alaska**
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**Title: Geologic Surficial-geologic map of the Chulitna region, southcentral Alaska**
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**URL: http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=3313**

**Title: Engineering-geologic map of the Chulitna region, southcentral Alaska**
**Publication: RI 2001-1D**
**URL: http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=3314**

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## I. BEDROCK UNITS

### SEDIMENTARY AND VOLCANIC ROCKS

**Ts**: Gravel and sand (Miocene? to Paleocene?) — Orange- to buff-colored, well-sorted, clast-supported, sandy pebble–cobble gravel and sand. Measured thicknesses of this unit range from 6 to 45 m. The deposit shows varying degrees of orange and purple-black (manganese oxide) discoloration and weathers to light buff or grayish brown.

**Tcs**: Coal-bearing sandstone (Oligocene?) — Poorly to moderately consolidated, light gray to yellow pebbly sandstone and pebble conglomerate with smaller quantities of brown micaceous silty claystone, carbonaceous claystone, and lignite. Lignite seams are dark brown on both fresh and weathered surfaces and break with a shaly fracture or irregularly along shrinkage cracks.

### KAHILTNA ASSEMBLAGE

**KJas**: Argillite and sandstone (Upper Jurassic to Lower Cretaceous) — Dark gray to very dark gray and black argillite (locally phyllitic) and dark gray sandstone. Rocks weather brown, orange-brown, and reddish-orange. Argillite is greater than 50 percent of this unit and locally sandstone may be as little as 10 percent of the unit.

**KJsa**: Sandstone and argillite (Upper Jurassic to Lower Cretaceous) — Sandstone with much lesser argillite. Predominantly dark gray, poorly sorted, sub-angular, fine- to medium-grained lithic sandstone, rhythmically layered with dark gray, locally carbonaceous argillite. Sandstone weathers dark gray, medium gray, and locally light gray or orange brown. Sandstone forms about 80 percent of this unit.

**KJc**: Conglomerate (Upper Jurassic to Lower Cretaceous) — Medium gray, poorly sorted, matrix-supported, polymictic pebble to cobble conglomerate. Matrix is fine- to medium-grained sandstone and constitutes about 15 to 20 percent of the rock. Clast estimates from the eastern part of the map

area are 70 percent quartz, 20 percent black argillite, and 10 percent gray chert (with rare white tripolitic chert).

#### OLDER ASSEMBLAGE

**KJs**: Calcareous sandstone and argillite, with coquinoid limestone (Upper Jurassic to Lower Cretaceous) —Predominantly medium gray, poorly and very poorly sorted, sub-angular with lesser sub-rounded, fine- to mdium-grained, tan to light gray, orange-brown weathering, calcareous, lithic sandstone.

**Jac**: Argillite, cherty argillite, and minor cherty tuff and basaltic tuff (Middle? to Upper Jurassic) — Mostly argillite exhibiting complex deformational fabrics and sub-greenschist metamorphic mineralogy. This unit is characterized by argillite and cherty argillite, with minor cherty tuff and basaltic tuff.

**Js**: Calcareous sandstone, sandy limestone, and argillite (Lower Jurassic) — Thin to medium, regularly bedded, brown weathering calcareous sandstone, sandy limestone and argillite. In places phosphatic and fossiliferous.

**TRrb**: Redbed sandstone and conglomerate (Upper Triassic) — Red- to maroon-weathering, calcareous siliciclastic rocks (especially sandstone, siltstone, and conglomerate). The sandstones are commonly coarse-grained, hematitic, red-weathering, (but less commonly light-green weathering) with local calcareous cement. Red-weathering, matrix-supported, well-rounded pebble conglomerate with pebbles of white quartz, basalt, and volcaniclastics is a distinctive lithology of this unit.

**TRs**: Brown sandstone and argillite (Upper Triassic) — Thick-bedded, yellow-brown weathering sandstone and argillite with minor calcareous sandstone and sandy limestone. Abundantly fossiliferous horizons yield large (4 cm diameter) heterastridium, snails, and bivalves of Late Triassic, Norian to Rhaetian age (loc. 150, 151 in Blodgett and Clautice, 2000).

**TRlb**: Basalt, basaltic tuff, and limestone (Upper Triassic) — Predominantly massive (occasionally pillowed) basalt and basaltic tuff 50–100 m thick, interlayered with fine-grained gray limestone. Near some contacts with basalt the limestone is coarsely recrystallized and sheared, other contacts display fossiliferous limestone immediately adjacent to basalt.

**TRb**: Basaltic dikes and sills (Upper Triassic) — Fine-grained, equigranular to porphyritic, strongly magnetic, mafic intrusive rocks, similar in appearance and indistinguishable in composition from the basalt of unit TRlb.

**uTrl**: Limestone (Upper Triassic) — Thin- to thick-bedded limestone with subordinate shale and calcareous siltstone, well bedded. Unit at least 300 m where well exposed in the upper reaches of Long Creek. Carbonate lithologies include mudstone, wackestone, packstone and even rudstone (rare); locally with silty and argillaceous admixtures.

**TRvs**: Red-colored tuff, andesite, basalt, graywacke, conglomerate (Middle? to Lower? Triassic, possibly older) — A predominantly volcanic and volcaniclastic unit of red-colored lithic tuff, lithic

conglomerate, graywacke, finely laminated tuffaceous siltstone and mudstone with minor basalt to dacite flows.

**lTRl**: Limestone (Lower Triassic) — Thin-bedded, light gray, light brown weathering mudstone and packstone. Recognized within small, high-angle fault slivers in two localities in the northeastern map area. Both exposures are less than 4 m in strike length and 1–2 m thick.

**Pl**: Limestone (Upper Permian) — Approximately 100 m thick succession of limestone subdivided into distinct lower and upper units (fig. 13). Lower unit composed primarily of medium- to thick-bedded, light to medium gray weathering limestone. Carbonate lithology is predominantly encrinoidal packstone to grainstone. Upper unit composed of medium- to thick-bedded limestone, light gray to orange-yellow weathering and locally highly silicified.

**PPs**: Permian mudstone and graywacke (Pennsylvanian? to Permian) — Unit is at least 200 m thick and composed of thinly bedded mudstone and graywacke. Lower part of unit dominated by gray-green graywacke turbidites that weather to yellow-brown, composed of lithic sandstones, 3–60 cm thick, interbedded with thin intervals of mudstone.

**uPzt**: Tuff (upper Paleozoic?) — Described by Jones and others (1980) as unit JTRt, part of the West Fork terrane, this unit is characterized by predominantly dark gray-green, andesitic to rhyodacitic composition ash and crystal tuff, subordinate argillite, and cherty argillite, siltstone, and graywacke, and minor volcanic flows. The ash tuff is commonly "flinty" and layered in 5–30 cm varicolored beds of green, white, and tan, and is clearly welded in places.

**uPzst**: Argillite and tuff (upper Paleozoic?) — With lesser siltstone and chert. Compositions and character of the varying rock types are the same as uPzt, although the relative proportions are different. In this area, sedimentary rocks comprise about 85 percent of the unit, volcanic tuffs about 15 percent.

**uPzs**: Chert, argillite, and graywacke (upper Paleozoic?) — Part of Jones and others (1980) Broad Pass terrane and Csejety and others (1992) Cretaceous melange. This unit is poorly exposed, and includes a variety of lithologies found in steeply incised drainages where continuous traverses are not feasible. Lithologies encountered include bedded chert (upper Paleozoic based on radiolarians, Jones and others, 1980) and carbonaceous, fissile black argillite with ellow- and orange-weathering salts, basalt, cherty tuff, green volcaniclastic rock, siltstone, graywacke (with black and occasionally red chert grains) and clast-supported, white quartz–pebble, black argillite (occasionally red argillite) conglomerate.

**Dv**: Andesitic tuff and flows (Upper Devonian) — Predominantly green-weathering, pyroxene andesite tuff and flows, but compositions range from island-arc tholeiitic basalt (locally pillowed) to dacitic tuff. Previously mapped as "Tertiary gabbro breccia" in the Golden Zone mine area (Hawley and Clark, 1974) and as part of a Devonian ophiolite (Jones and others, 1980). The lower contact is interlayered with Upper Devonian (Famennian) radiolarian chert.

**Dc**: Red and brown chert (Upper Devonian) — Radiolarian chert, massive to well layered, predominantly red and brown, but also green and black. Locally manganiferous, with up to 0.5 percent MnO, and ferruginous. Radiolaria indicate a Late Devonian (Famennian) age.

**Dl**: Limestone (Early? to Middle Devonian) — Medium- to thick-bedded, medium to dark gray lime mudstone to wackestone; locally fossiliferous with both rugose and tabulate corals, and brachiopods.

#### ROCKS OF UNKNOWN AGE

**sp**: Serpentinite gabbro and silica–carbonate rocks — Mixed unit varying from intensely serpentinized, chromite-bearing dunite to altered gabbro. Serpentinite is commonly altered to silica–carbonate rock and is otherwise strongly magnetic. Gabbro is commonly layered, and varies from fine- to coarse-grained and from leucocratic to melanocratic altered clinopyroxene–plagioclase rock.

**sp***: Aeromagnetic high, probable serpentinite and gabbro — This map unit is delineated by a narrow, strong magnetic signature that trends northeast through Broad Pass. Serpentinite was found in three locations in this area of little bedrock exposure and at one locality near basalt with major- and trace-element similarities to unit Dv.

#### INTRUSIVE ROCKS

**Tg**: Biotite granite (Eocene) — Textures range from fine-grained porphyritic (dikes) to coarse-grained, subequigranular. Normative compositions indicate most rocks are classified as alkali feldspar granite and lesser syeno–granite. Locally altered to tourmaline–zinnwaldite +/- biotite granite.

**Tb**: Basaltic-composition dikes (Eocene) — Narrow (0.3 – 2 m wide), fine-grained, dark-colored, mafic dikes that cut Late Cretaceous granites. Most readily distinguished in the field by rare clinopyroxene phenocrysts, up to 2 cm in size, and by occurrence with Tertiary granite. Major and minor element compositions indicate these are exclusively of basalt composition, and some are alkali basalt.

**Kg**: Late Cretaceous (hornblende) biotite granite — Monzo- and syeno-granite composition rocks with 40Ar/39Ar minimum ages (table 2) of about 61.4 to 71 Ma. On the west side of the Parks Highway these are seen as dikes and small stocks with granite porphyry textures; on the east side as large bodies of subequigranular granite with grain sizes of 2 mm to 2 cm.

**Km**: Intermediate composition plutonic rocks (Late Cretaceous) — Bodies of Km range in size from small stocks to narrow dikes, typically oriented northeast–southwest. Rock textures vary considerably, from fine-grained porphyritic to medium-grained, sub-equigranular. The dominant mafic mineral is hornblende; biotite is common in more felsic, and clinopyroxene in more mafic, varieties.

## II. SURFICIAL UNITS

### ALLUVIAL DEPOSITS

**Qa**: UNDIFFERENTIATED STREAM ALLUVIUM — Elongate deposits of moderately- to well-sorted, well-stratified, fluvial pebble–cobble gravel, sand, and silt, with rare to numerous boulders, deposited in active stream channels, flood plains, and associated low terraces. Deposit is medium to thick bedded, locally cross-bedded, and shows fining-upward cycles.

**Qac**: ABANDONED-CHANNEL DEPOSITS — Elongate variable deposits in channels of former meltwater streams not related to modern stream regimens and subsequent underfit streams.

**Qaf**: ALLUVIAL FAN DEPOSITS — Fan-shaped, heterogeneous mixtures of poorly to moderately sorted, partially stratified, channeled gravel with some sand and silt and scattered to numerous, subangular to rounded boulders, especially in proximal areas. Clasts locally derived. May include torrential fluvial deposits and debris-flow deposits. Thick to thin bedded.

**Qat**: TERRACE ALLUVIUM — Elongate deposits of well-sorted, well-rounded to subrounded pebble–cobble gravel and sand with trace to some silt and rare to numerous boulders up to 50 cm diameter comprising stream terraces bordering modern flood plains and clearly related to modern drainage; includes strath terraces.

**Qfp**: FLOODPLAIN ALLUVIUM — Elongate deposits of moderately- to well-sorted, well-stratified, fluvial gravel, sand, and silt with scattered to numerous boulders forming modern flood plains and associated low terraces. Typically mantled by thin layer of silty over bank deposits.

### COLLUVIAL DEPOSITS

**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.

**Qcl**: LANDSLIDE DEPOSITS — Oval- 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 creep, that is, flowing and sliding due to instability of failed bedrock and unconsolidated surficial deposits.

**Qct**: TALUS AND RUBBLE DEPOSITS — Irregular cones, drapes, and sheets of coarse (1 m diameter and larger blocks are common), heterogeneous, angular rock fragments and rubble with trace to some silt, sand, and gravel deposited more or less in place on steep upper slopes and at the mouths of steep bedrock couloirs by block weathering, frost riving, snow avalanches, free fall, tumbling, rolling, and sliding.

**Qrg**: ROCK–GLACIER DEPOSITS — Tongue- and fan-shaped heterogeneous mixtures of angular to subangular blocks of local bedrock and ice with trace to some gravel, sand, and silt at depth that accumulate on floors and lower walls of cirques by flow of rock glaciers derived from

shrinking of former glaciers (ice cored) or from deposition and cementation of precipitation-derived ground ice (ice cemented).

#### PALUDAL DEPOSITS

**Qs**: SWAMP DEPOSITS — Elongate to blanket deposits of complexly bedded peat, organic silt, and organic sand accumulated as surface deposits in local basins and in former stream channels. Saturated and locally frozen, locally ice rich. Thickness highly variable. Surface smooth, ridged, mounded, hummocky, or pitted. May have standing water.

#### GLACIAL DEPOSITS

**Qao**: OUTWASH ALLUVIUM — Elongate to fan-shaped heterogeneous mixture of washed, rounded to subrounded pebble–cobble gravel with some sand and silt and scattered to numerous subangular to rounded boulders deposited by meltwater streams draining margins of former glaciers. Thin to thick bedded, locally cross-bedded. Surface generally smooth and gently sloping, except for local low scarps.

**Qt2**: TILL OF LATEST HOLOCENE AGE — Heterogeneous mounds and ridges of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited at or near the margins of modern glacial ice or where glacial ice has existed until very recently; contains rare to numerous large (2 m diameter and greater) boulders.

**Qt1**: TILL OF EARLY TO MIDDLE HOLOCENE AGE — Heterogeneous mounds and ridges of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited directly from glacial ice; contains rare to numerous large (2 m diameter and greater) boulders.

**Qd**: DRIFT OF LATE WISCONSIN AGE — Heterogeneous blanket of pebble–cobble gravel, sand, silt, and clay in varying proportions deposited by glaciers; contains rare to numerous large (2 m diameter and greater) boulders deposited directly from glacial ice. Sorting, bedding, and clast roundness highly variable, depending on degree of water reworking. Deposit locally includes or is gradational with outwash.

#### COMPLEX DEPOSITS

**Qcf**: COLLUVIAL–ALLUVIAL VALLEY FILL, FAN, AND APRON DEPOSITS — Elongate, apron- and fan-shaped, heterogeneous mixtures of poorly to moderately sorted angular rock fragments with trace to some gravel, sand, and silt of fluvial and colluvial origin deposited at the bases of steep slopes bordering modern stream valley courses and at the mouths of bedrock couloirs and gullies.

#### MANMADE DEPOSITS

**Qh**: ARTIFICIAL FILL AND EXCAVATION SITES — Pebble–cobble gravel with trace to some sand and silt forming bases for roads and piled in active or former gravel pits. Well to poorly sorted. Surface smooth to irregular. Extent based primarily on distribution between July 1980 and July 1982 when the aerial photographs were taken.