/* ---------- CODESET ---------- */
Title: Preliminary Geologic Map of the Fairbanks Mining District, Alaska
Publication: PDF 96-16
URL: http://www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=1740
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I. DESCRIPTION OF SURFICIAL DEPOSITS

UNCONSOLIDATED DEPOSITS

ALLUVIAL DEPOSITS

Qal - Flood-Plain Alluvium: Well-stratified layers and lenses of unconsolidated silt, sand, and gravel. Locally perennially frozen with low ice content. Gravel consists of rounded quartz, quartzite, gneiss, granite, and schist clasts up to 20-cm diameter.

Qht - Reworked Creek Gravel Tailings: Placer-mine dredge tailings consisting of subrounded to angular gravel with cobbles and boulders up to 0.5-m diameter. Clasts are mostly quartzite, gneiss, and schist. Color tan to brown with much iron staining. Undisturbed gravel is buried except where exposed in walls of excavations.

Qafs - Silt-Fan Deposits: Alluvial-fan deposits overlying flood-plain alluvium and composed largely of silt with low organic content. Locally, at base of rock bluffs, includes beds and lenses of water-transported rock fragments and blocks moved down slope by gravity. Perennially frozen; no large ground-ice masses.

Qas - Swale and Slough Deposits: Poorly stratified lenses and layers of unconsolidated stream-laid silt and silty sand. Fairly well sorted with 10-30 percent clay. Color brown to grayish blue, mottled with carbonaceous material and iron staining. Perennially frozen with moderate to high ice content, chiefly as interstitial ice, veins, and stringers.

EOLIAN DEPOSITS

Qef - Fairbanks Loess: Massive, homogeneous, unconsolidated eolian silt. May include some retransported silt on slopes. Well-sorted, containing less than 10 percent clay. Locally cemented by iron oxide; locally calcareous. Locally mottled by thin carbonaceous layers and by iron oxide stains. Thickness 1 to several tens of meters thick. Generally not mapped on most hill tops and upper slopes where < 1 m thick.

Qer - Retransported Silt: Eolian silt retransported from hills to lower slopes and valley bottoms. Massive, homogeneous, unconsolidated; well sorted with less than 10 percent clay. Grains angular, consisting mostly of quartz, feldspar, and mica, locally cemented by iron oxide. Contains organic material, especially in valley bottoms. Perennially frozen with large masses of ground ice. May overlie benches of Tertiary gravel in valley bottoms.

COLLUVIAL DEPOSITS

Qc - Colluvium: Poorly sorted silt, sand and gravel derived by frost action and weathering of underlying bedrock and accumulating in aprons at the base of slopes.

Qcl - Landslide Deposits: Heterogeneous mixture of fractured bedrock, retransported silt, and possibly sand and gravel deposited by sliding due to instability of failed bedrock and unconsolidated surficial deposits. Surface slightly irregular with arcuate low hummocky ridges and degraded headwall scarps.

ORGANIC DEPOSITS

Qp - Peat: Perennially frozen brown to black peat with high ice content, composed of dense undecomposed plant remains consisting mostly of Sphagnum mosses.

Qos - Organic Silt: Organic-rich silt deposits of lowland bogs; incorporates much organic material, both plant and animal. Well sorted with less than 20 percent clay. Brown to grayish black, locally mottled by decomposed vegetation. Perennially frozen with numerous large masses of ground ice.

II. DESCRIPTION OF BEDROCK UNITS

TERTIARY SEDIMENTARY AND VOLCANIC ROCKS

Tb - Tertiary Basalt: Dark gray, maroon weathered, very fine grained to aphanitic, columnar jointed, olivine basalt and minor mudflow deposits. Locally contains leaf and plant stems including Metasequoia that indicate either Late Cretaceous or early Tertiary age, and samples from Browns Hill, Lakoely Hill, Fourth of July Hill, Birch Hill and Junniper Creek yield K-Ar and Ar-Ar whole rock isotopic ages of 50 to 56 Ma (Roe and Stone, 1993; this study). Moderately resistant where exposed.

Tbc - Concealed Tertiary Basalt: Subaerial basalt as in Tb unit that is covered by thick colluvial and alluvial deposits. Determined mainly by airborne aeromagnetic anomalies in southeastern portion of study area (DGGS, 1973).

Ts - Tertiary Conglomerate and Sandstone: Greenish gray, generally poorly consolidated, moderately well sorted, pebble conglomerate, and volcaniclastic sandstone mainly exposed on Fourth of July Hill in Fairbanks Creek drainage. Pebbles of greenstone, maroon phyllite, and black radiolarian chert indicate a provenance not of local origin, but rather a source area accessed when present drainage patterns in the study area were not developed. Association with Tb unit and presence of Metasequoia suggests Tertiary age. Nonresistant and poorly exposed.

CRETACEOUS PLUTONIC ROCKS AND RELATED ALTERATION

Ki - Altered Dikes: Tan to gray, usually ferricrete stained, altered quartz porphyry, tonalite, granodiorite, and undiffErentiated mafic dikes. Compositional estimates, where made, are based mainly on limited trace element and major oxide chemistry. Unit is generally nonresistant, due to ubiquitous alteration.

Kgd - Granodiorite: Medium to light gray, medium to coarse grained, equigranular to porphyritic, hornblende biotite granodiorite; CI ranges from 18 to 35. Plutonic rocks in Gilmore and Pedro Dome areas yield ages ranging from 89 to 94 Ma from Rb-Sr, Ar-Ar, and K-Ar methods (Blume,

Allegro, 1987, this study). Unit is resistant and underlies or forms prominent upland "domes" in the Gilmore, Pedro and Ester areas.

Kg - Granite: Light gray, tan weathered, medium to coarse grained, typically porphyritic, biotite granite. Contains significant gold mineralization in valley of Monte Cristo Creek, where silicification has resulted in resistant blocky bedrock exposures. Ar-Ar ages range from 88 to 93 Ma in Lincoln Creek and Gilmore Dome bodies (Blum, 1983; Allegro, 1987; this study).

Ktn - Tonalite and Quartz Diorite: Medium gray fine to medium grained, equigranular, biotite, pyroxene, hornblende tonalite and quartz diorite. Very resistant and forms rugged rubble outcrops in Pedro Dome region. Yields 93 Ma K-Ar, and Rb-Sr isotopic ages (Blum, 1983; this study).

Ksy - Nepheline Syenite: Medium gray, distinctively brownish-red altered, subfoliated, fine grained phaneritic, K-feldspar rich, nepheline syenite exposed in O'Conner Creek valley. Contains abundant megascopic zircon. Feldspar-nepheline grains up to 6 mm in long dimension oriented along foliation structure. Subfoliated texture may be from primary crystallization or the result of the mid-Cretaceous retrograde regional metamorphism that affected the metamorphic rocks throughout the study area. Entire pluton contains anomalous thorium, uranium, zirconium, and niobium. The O'Conner Creek pluton yielded a U-Pb zircon age of 110 Ma (J. Mortenson, written commun., 1996). Forms resistant blocky rubble in O'Conner Creek valley.

III. REGIONALLY METAMORPHOSED ROCKS

CHATANIKA TERRANE

PDe - Eclogite Bearing Schist Amphibolite, and Quartzite: Variably colored, light gray to dark green, fine to coarse grained metapelite, metabasalt, metamarl, metasandstone, and marble metamorphosed to eclogite facies conditions. Includes, (1) garnet clinopyroxene rocks (eclogite) with distinctive pale-pink garnet and olive green omphacitic pyroxene, (2) garnet clinopyroxene amphibole rocks with zoned garnet and pleochroic amphibole, (3) garnet amphibolite difficult to distinguish from similar units in the Fairbanks Schist, (4) light brown coarse grained calcareous muscovite schist, (5) dark gray garnet feldspar muscovite schist, (6) dark gray muscovite quartzite, and (7) nearly black, impure micaceous marble with minor clinopyroxene, phlogopite, and epidote. PDe unit is generally nonresistant, and forms subdued slopes in the northern portion of the map area. e=eclogite locality.

METAMORPHOSED GRANITIC ROCKS

Mog - Orthogneiss: Light gray, distinctly tan weathered, coarse grained, subfoliated, blasto-porphyritic, K-feldspar, biotite, muscovite granodiorite gneiss exposed in two, narrow, northeast trending belts that intrude the Fairbanks Schist in the eastern portion of the study area. U-Pb zircon age of 350 Ma (J. Mortenson, written commun., 1996) determined from a sample on Pedro Creek. Very similar to Augen Gneiss (Pzra) unit in Upper Chena River area (Smith and others, 1994) that intrudes "Chena River Sequence," which we regard as part of the Fairbanks Schist. Mog unit is moderately resistant, and forms coarse rubble whenever exposed.

MUSKOX SEQUENCE

Dmr - Metarhyolite: Light gray, tan weathered, medium to coarse grained, muscovite rich, blasto-porphyritic, metarhyolite schist. Unit is poorly exposed in an abandoned radio tower area on the top of Muskox ridge.

Dma - Amphibolite: Medium to dark green, medium grained, hornblende schist and amphibolite. Contains prograde hornblende, oligoclase, biotite, and quartz and retrograde actinolite, albite, chlorite, and epidote. Amphibolite contains low TiO2 values that differ somewhat from megascopically similar units in the Fairbanks Schist. Unit is generally nonresistant.

Dms - Biotite Schist: Medium to dark gray, distinctly brown weathered, medium grained highly schistose, quartz bearing, chlorite, biotite, mafic schist. Forms a distinctive linear band that tracks with amphibolite (Dma) along the southeastern flank of Ester Dome. Moderately resistant and forms stable outcrops in road cuts.

BIRCH HILL SEQUENCE

Dbs - Slate, Phyllite Tuff, Quartzite: Dark gray, locally bleached, fine grained, sub schistose, quartzite phyllite, and slate, which locally contains thin (<1 meter) layers of light gray feldspathic tuff that contains disseminated barite in Birch Hill area. Mineral assemblage includes chlorite, albite, illite and kaolinite. Can be moderately resistant due to high quartz content in interbedded quartzite beds.

Dbcs - Calcareous Schist and Impure Marble: Light gray, tan weathered, coarse grained schistose, calcite chlorite schist and impure marble. Best exposed along flanks of Ester Dome and in University Hill area. Generally nonresistant due to high carbonate content

FAIRBANKS SCHIST

Zf - Quartz Muscovite Schist, Quartzite, and Chlorite Quartzose Schist: Light to medium gray, fine to coarse grained, quartzite, quartz muscovite schist, and garnet biotite quartz muscovite schist. Rocks have been subjected to a prograde amphibolite facies event and a retrograde greenschist facies event. Early Proterozoic, detrital zircons are identified in many quartzite localities (Aleinikoff and Nokleberg, 1989). Unit is moderately resistant due to its relatively high quartz content.

Zfa - Amphibolite, Magnetite Rich Biotite Schist, Quartzose Schist, and Marble: Heterogeneous unit of variably colored, gray to green, fine to coarse grained, garnet hornblende amphibolite, magnetite bearing biotite schist, coarsely crystalline marble, and light gray, mica-rich quartzite or "white schist." Zfa as shown on the geologic map was originally mapped by Robinson and others (1990) as part of both the Chena River and Cleary Sequences. Amphibolites contain prograde hornblende, oligoclase, biotite, and garnet and retrograde chlorite, albite, actinolite, and sphene. Amphibolites contain high TiO2 and exhibit major oxide and trace element signatures typical of tholeiitic, "within plate" basalt (Pearce and Cann, 1973). Zfa unit appears as linear magnetic anomaly on an aeromagnetic survey (Dighem Surveys and Processing, 1995) due to magnetite content of biotite schist. Hydrothermally altered marble in Fox area juxtaposed against a high angle

fault zone contains numerous euhedral tremolite veins. Bleached, light gray muscovite quartzose "white schists" were originally regarded by Robinson and others (1990) as rhyolite tuff or exhalite; major oxide chemistry and trace element data collected during this study do not support this interpretation. Rather, presence of detrital zircons in these "white schists" (Aleinikoff and Nokleberg, 1989) indicate a metasedimentary parentage. Zfa is generally resistant and forms subdued rubble crop throughout map area.

Zfm - Marble: Light gray, medium to coarsely crystalline, muscovite rich marble. Where Zfm is in the vicinity of a 90 Ma pluton, small idocrase-garnet-hedenbergite-hornblende scheelite skarns have formed. Generally nonresistant.

Zfc - Metaconglomerate: Light gray coarse grained, quartz rich, porphyroclastic metaconglomerate that contains stretched pebbles of chert and shale in a well defined, 100 meter-thick bed that can be traced for about 10 kilometers in the Murphy Dome area. Very resistant and forms blocky rubble and outcrops

Zfg - Metasandstone Grit: Light to medium gray, quartz-rich, porphyroclastic muscovite, biotite metasandstone "grit" usually found in association with Zfc unit. Probably originally a quartz rich sedimentary rock deposited in continental margin environment. Similar to "grits" in Livengood Quadrangle (Weber and others, 1992) and in Upper Chena River area (Smith and others, 1994), which are regarded as Late Proterozoic quartzofeldspathic metasandstones. Very resistant and underlies the Murphy Dome upland in northwestern portion of map area.

Zfw - Bleached Feldspathic Quartzose Schist: Light gray, bleached, muscovite and biotite bearing, feldspathic schist. The Zfw unit is mapped in a linear belt across the summit of Ester Dome that has been offset along high angle fault. Occasional thin interbedded amphibolite layers found with the feldspathic Zfw schists. Petrographic studies and major oxide and trace element chemistry suggests that the feldspars are relict detrital grains from an arkosic metasedimentary rock rather than metavolcanic in origin. Some patchy areas underlain by the Zfw unit (for example, Murphy Dome, Parks Highway and Cleary Hill areas) may be hydrothermal alteration of quartzose schists related to nearby plutonism. Moderately resistant and forms blocky rubble in road cuts.

IV. DESCRIPTION OF MATERIALS UNITS (MAT)

GW - TAILINGS. Well graded gravels with little or no fines. Appears as steep imbricate gravel piles, locally leveled, 1 to >25 m thick. Primarily gravel clasts 2-15 cm diameter and some cobbles to >25 cm diameter. Low sand and silt content (<5 percent) as a result of dredging process. Only locally perennially frozen with low ice content.

GM-GW - ALLUVIUM. Silty gravels and poorly graded gravel-sand-silt mixtures to well graded gravels and gravel-sand mixtures with little or no fines. Alluvium along larger rivers is primarily clean, rounded gravel with layers of sand and minor silt, generally overlain by silt up to 1-4 m thick. Thickness of alluvium is 3 to >120 m. Contains discontinuous permafrost to known depths of 84 m; permafrost absent under rivers and lakes. Alluvium along small upland streams is up to several meters thick and contains variable proportions of stratified silt, sand, and gravel, with silt and sand often dominant.

GM - COLLUVIUM. Silty gravels and poorly graded gravel-sand-silt mixtures. Crudely bedded, heterogeneous mixtures of angular gravel, sand, and silt in variable proportions up to several meters thick (up to several tens of meters thick in landslide areas, Qls). May contain angular clasts up to several tens of centimeters in diameter. Locally perennially frozen with low ice content.

ML-SM - SLOUGH FlLLINGS. Inorganic silts to silty sands and poorly graded sand-silt mixtures. Contains 10-30 percent clay and minor organic material. Discontinuously frozen; permafrost may extend into underlying sand and gravel.

ML - LOESS AND SILT-FAN DEPOSITS. Inorganic silts and very fine sands with slight plasticity. Contains <10 percent clay and minor layers of sand and gravel and organic matter. Thickness 1-60 m thick in loess areas (Qef), 1-15 m thick in silt fans (Qafs). Permafrost generally absent in loess areas except in isolated patches with low ice content on north-facing slopes. Silt-fan areas contain discontinuous permafrost with moderate ice content.

OL - REWORKED SILT. Organic-rich silts with low plasticity. Contains <20 percent clay; locally contains minor lenses of sand and gravel. Thickness 10 to >100 m thick. Perennially frozen with high ice content in valley bottoms and locally along lower hillsides. Very difficult to excavate unless thawed.

Pt - PEAT. Spongy, wet, fibrous organic matter, 1 to >6 m thick. Perennially frozen with high ice content. Very difficult to excavate unless thawed. Good source of raw peat in thawed areas but poor drainage usually requires dewatering of excavation pits.

BV - Medium-jointed, fine- to medium-grained igneous rocks. Generally massive with evenly spaced joint sets and minor amounts of reactive minerals, such as feldspars and micas. In fresh exposures, BV rocks may be suitable for riprap, D-1, and crushed-aggregate applications. However, these rocks are frequently subjected to deep groundwater degradation and alteration of the network minerals potassium feldspar and plagioclase. This weathering can produce a sandy grus that significantly modifies or prohibits above-stated uses.

BC - Medium-jointed, fine- to coarse-grained meta-sedimentary rock; includes marble. May be useful for crushed-aggregate applications, but heterogeneous composition and texture cause physical properties to vary greatly.

BM - Medium-jointed, fine- to medium-grained quartzose meta-sedimentary rocks; includes meta-conglomerates. Fresh exposures of massive quartz-rich lithologies may be suitable sources of riprap and other structural-aggregate applications. Other more schistose varieties contain reactive minerals, such as muscovite, calcite, and plagioclase, which degrade to noncompetant and deeply weathered materials.

BO - Fissle, fine-grained meta-sedimentary rocks. Platy, fissile nature, couple with existence of reactive minerals muscovite, calcite, and plagioclase in finely laminated layers, suggest that these rocks generally are noncompetant and extensively weathered, making them unsuitable for structural applications. May serve as crushed aggregate for road-metal uses.

BU - Undifferentiated or variable rock lithologies. Heterogeneous unit that contains a wide variety of material properties. Main exposure on Fourth of July Hill is poorly lithified conglomerate and sandstone that exhibit properties similar to those found in placer-mine tailings (GW).