

PROFESSIONAL REPORT 92

PR92-SH1 PLATE 1 OF 2

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

ALLUVIUM, UNDIFFERENTIATED—Fluvial silt, sand, and gravel that form fans, terraces, and flood plains. Thickness varies from a few feet to several tens of feet. (See table 1 for engineering properties.)

TERRACE ALLUVIUM—Fluvial silt, sand, and gravel of various ages that compose fill and cut terraces; may also include strath terraces. In some places, mantled by an appreciable thickness of colluvial silt and a thick vegetation mat, especially where permafrost limits drainage. Older terrace deposits commonly

contain highly weathered clasts in a silty matrix; thus the deposits may not be

steep stream gradients and drastic seasonal fluctuations in stream energy. (See

suitable as a source of construction materials. (See table 1 for engineering properties.)

ALLUVIAL-FAN DEPOSITS—Poorly to moderately sorted fluvial silt, sand, and gravel that form deltoid fans where tributaries join higher order streams. In mountain trunk valleys, tend to be coarse grained and poorly sorted due to

COLLUVIUM, UNDIFFERENTIATED—Typically unconsolidated, unsorted deposits derived primarily from mass-wasting processes, such as creep and solifluction; earthflow, mudflow, and debris flow; and rockslide, snowslide, and rockfall. Includes primary products of bedrock erosion and retransported surficial deposits. Colluvium is widespread throughout quadrangle but is mapped only where appreciable thickness masks bedrock lithology and structure. (See table 1 for engineering properties.)

Deciable thickness masks bedrock lithology and structure. (See table 1 for engineering properties.)

LANDSLIDE DEPOSITS—Chaotically deformed colluvium derived from slow and continuous or sudden mass movement of bedrock or surficial deposits along planes of failure. Surface of landslide deposits are characteristically very hummocky and lack integrated drainages. Recent landslides show additional surface disturbances, such as randomly tilted trees and torn vegetation mats. Unit also includes rockfalls, which, in some cases, contain blocks to 40-ft (12-m) wide. In

western part of quadrangle, where glacially oversteepened headwalls occur, rockfalls result from spalling along joints of massive rock.

TALUS—Angular, frost-riven bedrock transported by gravity down cirque headwalls, avalanche chutes, and steep slopes and gullies. Forms cones or aprons at or near angle of repose along valley walls. Distal ends may grade into rock glaciers.

ROCK GLACIERS AND ROCK-GLACIER DEPOSITS—Unsorted, angular, frost-shattered cobbles and boulders, commonly containing considerable interstitial ice (up to 55 percent in active rock glaciers). Generally originate at 3,500 to 5,000 ft (1,100 to 1,500 m) in north-facing cirques and along steep valley walls of blocky-weathering, relatively resistant rock; may head in true glaciers or talus cones. Front of active rock glaciers very steep and unstable.

TILL AND TILLITES—Unsorted to poorly sorted clay- to boulder-size material deposited directly by glacial ice; calcite locally cements older tills, forming tillite. Cobble and boulder clasts are commonly striated, subangular to subrounded, and polyhedrally faceted. On plateau in northwestern part of quadrangle, moraines locally contain permafrost and are overlain by thick accumulations of peat. (See table 1 for engineering properties.)

THIN DRIFT OVER BEDROCK—Patchy, thin drift, including till and glaciofluvial deposits. Delineates former ice positions along valley walls but does not obscure underlying bedrock. Geochemical analyses of unit may be affected by presence of mineralized material moved long distances from parent sources.

OUTWASH—Stratified drift consisting of coarse, subrounded gravel with sand and silt lenses and partings deposited by sideglacial and proglacial meltwater streams. Deposits tend to fine down valley from former side and terminal glacial positions. Distal part of outwash bodies typically interfinger or merge gradationally with other alluvial deposits. (See table 1 for engineering properties.)

ABANDONED OUTWASH-CHANNEL DEPOSITS—Moderately sorted sand and gravel deposits formed in channels that were cut into bedrock or drift by meltwater from glaciers of predominantly late Wisconsin age. Locally may be good source for small to moderate amounts of aggregate materials.

ACTIVE GLACIERS—Occur in cirques with base levels above 4,800 to 5,200 ft

(1,500 to 1,600 m; elevations vary with aspect); termini are generally between 4,300 and 5,000 ft (1,300 to 1,500 m). Most glaciers in quadrangle appear to be in gradual retreat.

BEDDED ROCKS

CONGLOMERATE—Crudely stratified beds (15- to 50-ft thick; 5- to 15-m thick) of orange-weathering, gray-green, moderately indurated granule-pebble conglomerate. Composed of subangular, very poorly sorted clasts to 0.75-in. (2-cm) diam, with scattered (>5 percent), subrounded pebbles and cobbles to 3-in. (8-cm) diam. Unit locally derived, containing roughly equal amounts of igneous clasts from Tids unit and phyllitic calcareous-sandstone clasts from Ss unit. Unit occurs in fault sliver in northeastern part of T. 23 N., R. 27 W. Age uncertain but assigned to Tertiary by Herreid (1968) on basis of restricted oc-

ANDESITE FLOWS—Mafic to intermediate volcanic rocks in northeast corner of quadrangle. Display columnar jointing.

GREENSTONE—Altered, olive-green, locally schistose mafic volcanic flows, agglomerate, and tuff(?). Includes subordinate thin, lenticular beds of gray marble.

LIMESTONE, CALCAREOUS SANDSTONE, AND SHALE—Very thinly bedded, orange- to buff-weathering calcareous siltstone to fine-grained sandstone (30 percent); cross-bedded silty limestone (30 percent); and dark-gray phyllitic shale (30 percent). Includes scattered lenses of dark-gray laminated limestone to 6-ft (2-m) thick (5 percent) and fine- to medium-grained calcareous sandstone, as in Ss unit, to 6-ft (2-m) thick (5 percent). Isoclinally folded on all scales and commonly sheared. Equivalent to DSIs unit of Bundtzen and others (1987) to the east and DSIs and DIs units of Gilbert (1981) to the southwest. Top of unit not exposed in McGrath A-3 Quadrangle, but to east Bundtzen and others (1987) estimated unit reaches maximum thickness of 1,200 ft (400 m).

PHYLLITIC CALCAREOUS SANDSTONE—Very thinly to very thickly bedded,

buff- to orange-weathering, gray to gray-green phyllitic calcareous sandstone; interbedded with lesser amounts of thinly laminated to thinly bedded, orange- to brown-weathering, black to gray or gray-green slate and phyllitic calcareous siltstone. Locally contains partings of thinly laminated, silver-weathering gray phyllite and intervals of very thinly to thinly bedded, gray silty limestone.

The phyllitic calcareous sandstone is a very fine to very coarse grained micaceous feldspathic litharenite (Folk, 1968) with abundant secondary minerals. Original detrital mineralogy and texture is evident in thin section in some samples (Gilbert and others, 1988), but the coarser clasts are commonly flattened and stretched. The sandstone displays pervasive foliation defined by elongate, partially recrystallized framework grains and cataclastic shear planes. In the north-central part of the quadrangle, the sandstone exhibits graded bedding, oscillation ripple marks, and planar cross-bedding. The phyllitic siltstone commonly grades into the calcareous sandstone or siltstone and occasionally displays cross-beds and pyrite crystals on partings.

In general, unit contains subparallel, crosscutting quartz and calcite veinlets and is typically hornfelsed parallel to contacts with igneous units. From outcropto nappe-scale, unit is subisoclinally to isoclinally folded. Correlative with mSs, mSa, mSl, uSl, Ss, and uSsl units of Bundtzen and others (1987). Thickness unknown due to structural repetitions and faulting.

1s - Thinly to very thickly bedded, medium-gray weathering, dark-gray laminated

limestone. Generally included as part of Ss unit but locally mapped separately as ISI unit.

g - Medium-grained chlorite-hornblende-augite greenstone.

LIMESTONE—Thinly laminated, gray limestone that locally marks base of Ss

in cores of Middle Fork and North Fork anticlines.

unit; may contain very thin layers of black chert. Correlative with ISI unit of Bundtzen and others (1987). Varies from 0-to 90-ft (0- to 30-m) thick.

BLACK SHALE—Black to dark-gray, locally pyritic shale, siltstone, argillite, phyllite, and very fine grained sandstone in northwest and southwest parts of quadrangle. Includes beds of fine- to medium-grained sandstone and occasional layers of silty limestone. Also includes scattered beds (0- to 2-in. thick; 0- to 5-cm thick) of dark-gray limestone in basal 20 m that overlie silty limestone unit (OEls). Shale unit slightly to intensely sheared and folded. Contains Upper

Ordovician to Lower Silurian graptolite-bearing horizons (table 2). In McGrath

A-3 Quadrangle, unit is about 800-ft (250-m) thick but is structurally thickened

SILTY LIMESTONE—Very thin to medium (up to 10-in. thick; up to 25-cm thick), lenticular beds of orange-weathering, light-gray silty limestone in north-west and southwest parts of quadrangle; interbedded with thin (0.5- to 2-in. thick; 1-to 5-cm thick) beds of gray siltstone and gray carbonaceous phyllite. Silty laminae commonly cross-bedded in several stacked cosets. Unit rarely cut by calcite veinlets. Generally sheared along limestone-siltstone contacts and siltstone-phyllite partings. Deformed into tight chevron and subisoclinal folds that range from crenulations to nappes. Base of unit not exposed in map area; however, in adjacent quadrangles to southwest, Gilbert (1981) estimated minimum thickness

for unit of 3,000 ft (1,000 m). INTRUSIVE ROCKS

WINDY FORK GRANITE—White to pink and blue-gray medium- to coarse-grained, hypidiomorphic-granular peralkaline arfvedsonite granite of Windy Fork pluton. Composed of perthite (40 to 60 percent), quartz (25 to 45 percent), and arfvedsonite (5 to 10 percent), with secondary riebeckite (<2 percent); may contain minor plagioclase and red-brown biotite. Accessory minerals include opaque grains, zircon, fluorite, apatite, monazite(?), and carbonate. Presence of uranothorite or thorianite may cause radioactivity to 2,500 cps in Windy Fork pluton (Reed and Miller, 1980). Eudialyte and aegirine-augite occur in veins that cut granite and adjacent country rock. One sample of aegirine-augite from margin of Windy Fork pluton (table 3, site 7) yielded K-Ar age of 23.5 ± 0.7 m.y. Reed and Lanphere (1972) reported K-Ar ages from biotite and hornblende in the Windy Fork pluton of 30.1 ± 0.9 m.y. and 29.0 ± 0.9 m.y., respectively.

MAFIC DIABASE—Diabase intrusion of the Chip Loy prospect (located in northeast quadrant of map). Composed of unaltered labradorite laths (<50 percent), clinopyroxene (25 percent), tremolite (20 percent), magnetite (3 percent), biotite (1 percent), and apatite (1 percent) (Herreid, 1968). Includes 39-ft (12-m)-thick sulfide-rich zone along iron-stained contact between diabase and phyllitic calcareous sandstone unit (Ss). Sulfide zone consists of pyrrhotite (50 to 70 percent) with minor chalcopyrite, pentlandite, magnetite, and possible bravoite (table 4; W.S. Roberts, written commun., 1984). Age of intrusion uncertain, although assigned to Tertiary on basis of similarities to Tertiary pyrrhotite-rich intrusions in McGrath B-2 Quadrangle (Bundtzen and others, 1982).

MONZONITE—Medium-grained, hypidiomorphic-granular clinopyroxene-horn-blende monzonite that intrudes greenstone unit (MzPzg) in northwest corner of quadrangle. Contains pyroxene (pink in thin section) surrounded by hornblende (35 to 40 percent), labradorite (30 to 40 percent), alkali feldspar (20 to 25 percent), anhedral opaque minerals (3 to 5 percent), minor biotite, and apatite. Secondary minerals include white mica and green amphibole after hornblende.

FELSIC SILLS AND DIKES—Generally light pink-tan to white, aphanitic to fine-grained felsic sills and dikes to 15-ft (5-m) thick. Commonly altered to and coated with brown-orange gossan.

QUARTZ MONZONITE—Fine- to medium-grained, hypidiomorphic-granular biotite quartz monzonite that composes small plug in northwest corner of quadrangle. Alkali feldspars are perthitic. Hornblende is present in minor amounts. Accessory minerals include zircon, titanite, and apatite. Biotite from K-Ar sample (table 3, site 1) yielded age of 56.6 ± 1.7 m.y. Reed and Lanphere (1972) reported K-Ar age of 56.0 ± 1.6 m.y. from biotite of same intrusion.

MIDDLE FORK PLUTONIC COMPLEX

GRANITE, QUARTZ MONZONITE, AND MONZODIORITE—Fine- to medium-

GRANITE, QUARTZ MONZONITE, AND MONZODIORITE—fine- to medium-grained, hypidiomorphic-granular biotite- and hornblende-bearing plutonic rocks with variable quartz contents and feldspar ratios; predominantly quartz monzonite and monzodiorite (Streckeisen, 1973). Plagicclase composition ranges from andesine to labradorite; minor clinopyroxene generally present and rimmed by hornblende; locally contains alkali feldspar phenocrysts. Accessory zircon, appetite, and opaque minerals ubiquitous; tourmaline present in some areas. Finegrained mafic enclaves common; most have wholly igneous texture, though some retain layering of sedimentary origin. Intruded locally by leucocratic veinlets of quartz and alkali feldspar. In places, includes alkali gabbro unit (Tgb) and underlying syenite unit (Tsy). Contact with syenite (Tsy) on peak at 6,375 ft (1,980 m) is sharp and near horizontal. Elsewhere, contact with syenite unit (Tsy) is diffuse, possibly due to mixing of units in semicrystalline state. Three K-Ar samples (table 3, sites 2, 3, and 4) yielded ages of 56.1 ± 1.7 m.y., 56.6 ± 1.7 m.y., and 57.2 ± 1.7 m.y., respectively.

ALKALI GABBRO—Dark-green-brown, fine- to medium-grained, subophitic

biotite-olivine-pyroxene gabbro. Typically composed of andesine (30 to 55 percent), clinopyroxene (10 to 25 percent), biotite (2 to 30 percent), olivine-(5 to 20 percent), and green to brown hornblende after pyroxene (1 to 2 percent). Minor constituents include opaque minerals (1 to 10 percent), alkali feldspar (0 to 5 percent), orthopyroxene (0 to 5 percent), and accessory apatite. Secondary minerals include chlorite, iddingsite, serpentine, actinolite, carbonate, and apophyllite. Crystallization sequence: olivine-pyroxene-plagioclase-biotite-hornblende. Locally layered due to segregation of mafic minerals. Unit commonly intruded by crosscutting leucocratic veinlets of quartz and alkali feldspar, locally in graphic intergrowth, with traces of biotite and opaque minerals. Gabbro typically weathers to brown grus, which forms rounded outcrops. In places, unit includes small bodies of granite, quartz monzonite, and monzodiorite (Tgum). Layered gabbro in sec. 1, T. 23 N., R. 28 W. intrudes syenite (Tsy) at sharp contact; elsewhere, contacts generally gradational.

GRANITE—Fine- to coarse-grained, hypidiomorphic-granular granite to quartz syenite of Middle Fork pluton. Color index = <25. Contains hornblende (0 to 10 percent), clinopyroxene (0 to 10 percent), and biotite (0 to 5 percent), with minor opaque minerals, apatite, and zircon; arfvedsonite and riebeckite present locally. Alkali feldspar generally perthitic and commonly pink in hand specimen. Modal quartz ranges from 10 to 25 percent. Locally contains fine-grained, pyroxene-rich mafic enclaves. Unit typically weathers to white grus.

SYENITE—Green-gray, white-gray weathering, medium- to coarse-grained, hypidiomorphic-granular olivine-clinopyroxene syenite of Middle Fork pluton; locally iron stained. Composed of perthitic alkali feldspar (45 to 90 percent), green-brown hornblende after pyroxene (1 to 20 percent), clinopyroxene (3 to 10 percent), plagioclase (3 to 10 percent), olivine with magnetite alteration rims (1 to 7 percent), and interstitial quartz (0 to 10 percent). Minor constituents are biotite (0 to 3 percent), opaque minerals (1 to 2 percent), rutile needles (<1 percent), apatite (<1 percent), zircon (<1 percent), fluorite(?), and monazite(?). Secondary minerals include chlorite, carbonate, iddingsite, actinolite, and epidote. Typically forms massive, jointed cliffs. At several localities, includes bedded country rock and plutonic bodies of Tgqm unit.

MIDDLE FORK GRANITE—Medium- to coarse-grained, hypidiomorphic-granular

mIDDLE FORK GRANITE—Medium-to coarse-grained, hypidiomorphic-granular peralkaline granite of southeast margin of Middle Fork pluton. Color index = 8 to 10. Middle Fork granite is very similar in mineralogy to Windy Fork granite (Twg) and appears gradational with syenite unit (Tsy). Eudialyte noted in granite talus at two locations. Outcrops typically massive and weather in large blocks. Amphibole from K-Ar samples (table 3, sites 5 and 6) yielded ages of 57.7 ± 1.7 m.y. and 55.6 ± 1.7 m.y., respectively.

DIKE SWARM—Swarm of subparallel mafic dikes and minor felsic dikes; slivers of Ss are particularly abundant within 1,500 ft (500 m) of Tids-Ss contact. Dikes commonly consist of fine-grained andesine laths, biotite, clinopyroxene (titanaugite in some mafic dikes), olivine, and opaque minerals with pervasive chlorite and carbonate alteration.