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GEOLOGIC MAP, STRUCTURE SECTIONS, AND ROCK UNIT DESCRIPTIONS, McGRATH A-2 QUADRANGLE, ALASKA

By

T.K. Bundtzen, J.T. Kline, T.E. Smith, and M.D. Albanese

Alaska Division of
Geological and Geophysical Surveys

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794 University Avenue, Basement
Fairbanks, Alaska 99701

SURFICIAL UNITS

Qa STREAM ALLUVIUM UNDIFFERENTIATED - Fluvially derived silt, sand and gravel on modern floodplains and fans. Size classification, degree of sorting, and stratification vary according to the size, regime, and sources of bedload in streams which deposited sediments. Deposit thicknesses vary from a few meters in incised streams near valley heads to 100 m on Post River floodplain.

Qaf ALLUVIAL FAN DEPOSITS - Poorly to moderately well sorted fluvial, delta shaped, silt, sand and gravel deposits occurring where tributaries join higher order streams or along eastern piedment of Post River valley. Fan accumulations in mountain trunk valleys tend to be poorly sorted and material size is coarse owing to steeper gradient, and rapid seasonal fluctuations in stream energy.

Qat ALLUVIAL TERRACE DEPOSITS - Fluvially derived silt sand and gravel deposits of varying age occurring on strath terraces or as fill terraces resulting from episodes of alternate down cutting and aggradation. In some places terrace alluvium may be mantled by appreciable thicknesses of eolian and/or colluvial? silt as well as a thick vegetation mat, especially where permafrost limits drainage.

Qct TALUS - Angular bedrock weathering debris derived from frost riving and rapid gravity transport on steep slopes, cirque headwalls, steep gullys and avalanche chutes; usually forms cones or aprons lying at or near the angle of repose along valley walls. Distal ends may transcend into rock glaciers.

Qls LAND SLIDE DEPOSITS - Chaotically deformed deposits derived from catastrophic mass movement of bedrock or surficial deposits along planes of failure. Surfaces of Qls units are characteristically very hummocky and lack integrated drainages. Recent slides display surface disturbances, such as randomly tilted trees and ripped up vegetation mats.

Qca COLLUVIAL - ALLUVIAL DEPOSITS - Poorly to moderately well sorted silt, sand, and gravel and diamicton of colluvial and occasionally fluvial origin. Deposits commonly contain alternating stratified and unstratified zones or lenses in gullys and steep minor tributaries with intermittent or ephemeral stream flow. Colluvial-alluvial fans generally are most active in early to late spring during breakup when intense freeze thaw cycles and melt water are present.

Qrg ROCK GLACIERS AND ROCK GLACIER DEPOSITS - Deposits of unsorted, angular frost shattered boulders and cobbles, commonly containing considerable interstitial ice (up to 55 percent in active rock glaciers). Deposits in the region are basically of three morphologic types, 1) Lobate, relatively small foms 50 to 200 meters across lying at the base of valley walls and whose direction of movement is toward the valley axis; 2) tongue shaped, having their longest dimension parallel to their direction of flow, heading in cirques and 3) transitional forms elongated down valley in direction of flow with its head being a true glacier and terminus gradually transitioning into a rock glacier. Fronts of active rock glaciers in the area are very steep and unstable; rock glaciers in the area are commonly oriented in cirques eroding blocky, weathered, resistant igneous rocks and having a northerly aspect at elevations between 3,500 and 5,000 feet.

Qdt TILL - Diamicton deposited directly by glacial ice. Characteristically unsorted tc poorly sorted with varying percentages of clay, silt, sand, pebble, cobble and boulder size material. Cobble and boulder clasts commonly polyhedrally faceted, striated, and tending to be subangular to subrcuaded. Per&frost and thick surface peat accumulations are common in moraines lying on piedmont slopes.

Qdo OUTWASH - Glaciofluvial, stratified drift consisting of coarse, subrounded gravel with sand and silt lenses and partings deposited by side glacial and proglacial meltwater streams. Outwash deposits tend to be graded to former side and terminal glacial positions. Material deposited proximal to the glacier (or former glacier) is generally coarser than material distal to it. Distal portions of outwash bodies generally merge gradationally with other alluvial deposits and lose their identity..

Qdic ICE CONTACT DEPOSITS - Stratified glacial drift deposited in contact with melting glacial ice. In the study area these diamicton 2nd stratified depostis take the land form of kame terraces, kames and eskrr complexes marked by ncmerous kettles.

Qof OUTWASH FAN DEPOSITS - Unsorted to moderately sorted sand, grave?, and mixed debris deposited prcximal to ice margin21 melt rater streams cf Wisconsinan age.

KJs SHEARED SANDSTONE AND SHALE - Medium to dark gray, siltstone, shale and fine grained lithic sandstone containing angular to subangular clasts of lithic fragments (25 percent) feldspar (10 percent), chert and quartz (40 percent) and volcanics (25 percent). Sand occurs in typically cyclic graded beds 3 cm to 30 cm thick. Flutes, ripple marks and flame structures locally abundant. Unit is highly sheared and appears to be more deformed than the Dillinger Group; low angle cleavage implies that structural style is that of recumbant isoclinal folding overturned to the northwest. Two fossil localities yieid Inoceramus shells of Early Cretaceous age but regionally the unit contains fossils of Late Jurrasic age (Eakins and others, 1971). Thickness unknown.

PDc LIMESTONE-CHERT CONGLOMERATE - Distinctively tan to reddish weathered, variable gray to brown, pebble-to-cobble limestone-chert conglomerate containing rounded clasts of limestone (40 percent) black to gray chert (40 percent) sandstone (10 percent), and shale debris (10 percent),. The 160 m thick section grades from a limestone breccia near its base to a limestone chert conglomerate midway through the section to a chert-sandstone conglomerate near the top. Most clast sizes are in the 3 cm diameter range but some exceed 20 cm in long dimension. It overlies a coarse graded Bouma A-B arkosic sandstone that contains pebble conglomerate channel deposits 1-3 m wide and about 1 m thick. Pebbles and cobbles in the conglomerate are locally imbricated and also shot: crude channel configurations. Fossil control is so far lacking.' The unit is very similar to coarse clastic deposits of the Mystic Terrane described by Reed and Nelson (1980) in the Mt. Dall area of the Talkeetna Quadrangle, which ranges in age from Devonian to Permian.

PDl MASSIVE TO SERIATE LIMESTONE - Medium to dark gray carbonaceous, rhombehedrally veined, recrystallized limestone showing seriate-like or algal-like laminations 1-3 cm thick and unusual layers of black cherty limestone globules about 2 cm in diameter. Isoclinally folded in southeastern corner of nap area. Assigned Devonian-Mississippian age on the basis of interbedded relationship with PDs. Thickness unknown but outcrop examinations suggest 100-150 m range.

PDs SUBLITHIC SANDSTONE - Tan to brown, medium to coarse grained, quartzose, sublithic sandstone and pebble conglomerate composed of polycrystalline quartz (40 percent), chert (20 percent), albite (5 percent), volcanic clasts (5 percent), and lithic fragments (25 percent). Rip-up clasts and iron stained concretions are very common but graded bedding is uncommon and only confined to coarse AB Bouma intervals with CDE facies notably absent. Significantly thin sections analysis show an absense of detrital white mica and calcite cement that characterizes Silurian clastic units in study area. Additionally fragments of plant stems are locally abundant and sometines confused for graptolites. Grains are subangular to subrounded in contrast to angularity of grains in older clastic units. Fossils have not been found within the study area but we tentatively correlate MDs with sandstone and shale of Middle Devonian to Upper Pennsylvanian age in the McGrath B-2 Quadrangle (Bundtter, Kline, and Clough, in process). Thickness is unknown but at least 900m.

DSl LAMINATED TO MASSIVE LIMESTONE - Medium to dark gray, laminated to locally mtssive, recrystallized limestone. Generally contains silty partings algal-like structures, and characteristic veins of rhombchedral calcite. Slumped carbonate breccia and limestone conglomerate channels 1-6 m thick observed in northwestern corner of study area. Overlies upper Silurian limestone (uS1) and underlies Middle Devonian units in McGrath B-2 Quadrangle described by Bundtzen, Kline, and Clough (1982). Unit varies from 100-300 m thick.

DSls THIN TO THICK BEDDED LIMESTONE, CALC-SANDSTONE AND SILTSTONE -

Predominantly very thin to very thick bedded, buff- to orange-weathering, light- to medium-gray, phyllitic calcarenite; thinly laminated to thin-bedded, orange- to brown-weathering, gray to gray-green phyllitic talc-siltstone; and very thin bedded gray silty limestone. Calcarenite is micaceous, coarse to fine grained, with local cross-bedding and graded bedding; coarse sandstones cataclastically deformed with clasts commonly flattened and stretched. Phyllitic siltstone commonly grades into calc-sandstone or limy siltstone; rarely displays cross-beds and pyrite crystals on partings. Silver-weathering, thinly laminated gray phyllites occur locally as partings and layers up to several meters thick; sub-parallel and crosscutting quartz and calcite veinlets common. Unit contains from 5 to 35 percent light-gray, thin-bedded, laminated limestone. Locally DSls contains channelized limestone conglomerate, graded coarse pebble sandstone, and slumped carbonate breccia zones 1-2 m thick that suggests both turbidite fan and foreslope deposition21 environments. Unit is unfossiliferous but overlies upper Silurian limestone (uSl) and underlies middle Devonian or younger units in McGrath B-2 Quadrangle described by Bundtzen, Kline, and Clough (1982). True thickness is unknown but believed to be a maximum of 300-400 m.

Sl LIMESTONE - Medium to dark gray, recrystallized, laminated limestone interbedded with minor amounts of phyllitic carbonaceous shale. Very similar to other Silurian limestone units in map area (mSl, uSl, lSl) and those described by Gilbert and others (1984) but notably unfossiliferous. Hence age assignment based on lithologic similarities to the dated units described. Thickness is unknown but reaches a maximum of 150 m in western portion of study area.

uSsl THIN BEDDED CALC-SANDSTONE, LIMESTONE, AND SHALE - Predominantly thin bedded buff to orange weathering, phyllitic calcareous lithic sandstone interbedded with thinly laminated medium gray to olive green shale and light gray linestone. Calc-sandstone is micaceous, chert and quartz rich, very coarse grained to fine grained, and locally displays graded bedding. Flutes, ripples and crossbedding are uncommon to absent, but clast conpositions indicates classification as a feldspathic litharenite as in the mSs unit. Subparallel and crosscutting carbonate veins are common. Unit is isoclinally folded but believed to be 300-400 m thick. Lies stratigraphically above Ludlovian limestone (uSl).

Ss SANDSTONE AND SHALE - Brown to gray, medium to coarse grained, micaceous lithic sandstone, shale, and very minor Limestone. Graded bedding, flute casts, ripple marks, and clast compositions essentially identical to those found in mSs, uSsl, and mSa units. Unit is unfossiliferous and lacks adequate age control; it is probably equivalent to one or several of the Silurian clastic units described here and by Gilbert and Solie (1983). Thickness unknown due to complex folding and younger intrusive dike swarms.

usl LAMINATED LIMESTONE - Medium to dark gray, recrystallized, laminated limestone very sililar to mSl unit, but contains graptolites of Ludlovian (upper Silurian) age in the McGrath B-2 Quadrangle (Bundtzen, Kline, and Clough, 1982). This unit roughly forms the boundary between the mSs sandstone- and uSsl thinbedded lithologies. uSl varies from 10-35m thick and is of mappable thickness only when structurally thickened by folding.

mSl LAMINATED LIMESTONE AND MINOR SILTY SANDSTONE - Medium to dark gray, recrystallized, laminated limestone interbedded with minor amounts of brown to gray carbonaceous graptolite-bearing silty sandstone; the latter of which yields Wenlockian (Middle Silurian) greptolite zones. Unit varies from 20-60 m thick in study area but characteristically isoclinally folded.

mSa SHALE AND MINOR SANDSTONE - Light gray, brown weathered, siltstone, shale, and minor lithic sandstone; sandy intervals contain cross laminations, flute marks, longitudinal ripples and graded, 1/2 m thick, BCDE to ABCD Bouma intervals. Sand-shale ratio is approximately 1:3. Unit interfingers with lower and middle portion of main mSs unit; it probably represents an overbank deposit or inactive portion of a turbidite fan. Unit is unfossiliferous but bracketed between Lower and-Middle Silurian fossiliferous limestone members (lSl, mS1).

mSs SANDSTONE, SILTSTOKE, AND MINOR SHALE - Medium olive gray to terra cotta, medium to coarse grained, massive to locally thin bedded, calcareous, lithic sandstone, pebble conglomerate, and siltstone with localized gray shale intervals. Sandstone and conglomerate beds composed primarily of polycrystalline quartz (30 percent), chert (20 percent), detrital carbonate (15 percent), altered feldspar (5-10 percent), metris (15-16 percent), white mica (3-8 percent) and carbonate and iron cement (5-8 percent). Limited point count work on four sandstone samples indicates classification as a feldspathic litharenite after Folk (1968) in a recycled orogen provenance. Sandstones contain oscillation ripple marks, flute casts, graded bedding and Bouma ABCD intervals suggestive of deposition by turbidity currents; planar crossbedding is well defined in the C interval. Sand-shale ratio increases upward through the unit. We interpret mSs unit as forming in a mid-fan turbidite facies. Unit is generally unfossiliferous but bracketed between lower and upper Silurian limestone; mSs is interbedded with middle Silurian limestone (mS1). mSs unit varies from 200-350 m thick throughout map area.

ISl LIMESTONE AND MINOR BLACK CHERT - Light tc medium gray, finely laminated, recrystallized limestone containing several 1-5 cm thick brownish westhered, graptolite bearing, carbonaceous siltstone, and locally, black, crackled, recrystallized chert. Sheep Creek in McGrath B-Z Quadrangle, and several fossil localities in map area contain the upper Lower to lowest Middle Silurian graptolite Cyrtograptus centrifugus. ISl unit varies fron 10-30 m thick and is mappable at 1:63,360 scale only when structurally thickened by isoc.linal folding.

SOsh DARK GRAY SHALE, SILTSTONE, AND MINOR CHERT - Dominantly medium to dark gray, fissle, isoclinally folded carbonaceous shale and siltstone; banded dark gray to black chert, bioturbated siliceous siltstote, and tuffaceous sandy layers. are interbedded with shale in the upper 90 m of section. Local horizons _ 1 m thick of shale chip intraformational conglomerate near top of section. Ten to 100-cm-thick BCDE Bouma intervals also occur in upper portion of section. Sulfur-smithsonite(?) plumes on joint surfaces and uncommon 1-5 cm thick stratiform pyritic zones distinguish SOsh shale from similar Faleozcic strata of younger age. Churkin and others (1977) and Bundtzen, Kline, and Clough (1982) report 11 graptolite zones from Sosh ranging from Tetrcgraptus approximatus to Monograptus spiralus known from Ordovician-lover Silurian rocks worldwide. SOsh unit Is usually structurally thickened but appears to range from 100 m tc 280 m thick in map area (MacDonald, 1984, In process).

OCls INTERBEDDED SILTY LIMESTONE AND SHALE - Rhythmically layered, thin bedded, orange to buff weathering, light gray, silty, laminated to crossbedded limestone and medium grap to olive green shales. Limestone and shale interbeds range in thickness from 10 cm to 50 cm and average 25 cm. Crossbedding in limestone occurs usually in the form of several stacked tabular or wedge shaped cosets 3-15 cm thick. Shale and'siltstone interbeds commonly ripple laminated with amplitudes of 2-60 cm. Limestone interbeds display occasional graded BCDE intervals. Unit rarely cut by calcite veinlets; siltstone-shale partings commonly develop into mica-sheaned phyllite along shear zones. Unit is characteristically isoclinally folded on scales from crenulations to nappes. OCls lithologies underly lowest Ordovician Tetragraptus approximatus zones in overlying SOsh unit, and is tentatively correlated with similar units of Cambrian and lowest Ordovician age in the Selwyn Basin of Canada's Yukon Territory (Bundtzen and. Gilbert, 1983). Base of OCls is not exposed in map area; Gilbert (1981) estimates a thickness of at least 1,000 m in the Cheeneetnuk River area for an equivalent unit.

Tqp QUARTZ PORPHYRY - Light gray, brown-tan weathered, porphyro-aphanitic, quartz-feldspar porphyry generally containing variable amounts of disseminated to massive pyrite zones and locally on Bowser Creek containing deposits of zinc, lead, and silver vein mineralization. Believed to be comagmatic with late phase of Tqm intrusives. Whole rock age of 63.0 m.y. obtained from Bowser Creek locality (table 1).

Tif FELSIC SILLS AND DIKES - Felsic sills and dikes up to 5 m thick, generally light-pinkish tan to white, aphanitic to fine grained, rarely medium grained, both hypocrystalline and holocrystalline with phenocrysts of plagioclase and alkali feldspar; groundmass highly altered with abundant secondary carbonate. Some felsites contain fine-grained disseminated pyrite and display banding caused by variable grain size and texture. Commonly associated with brown to orange flerricrete gossan. Undated but felsic dikes intrude mafic dikes (Tim).

Tim MAFIC SILLS AND DIKES - Mafic sills and dikes up to 5 m thick, generally dark brown, fine grained, panidionorphic-granular, locally porphyritic or amygdaloidal; cm western boundary of quadrangle some contain abundant biotite and display ocellar textures suggestive of lamprophyres. believed to be conagnetic with 57.0 m.y. old Middle Fork pluton mapped by Gilbert and Solie (1963).

Tqm_{br} QUARTZ MONZONITE AND IGNEOUS BRECCIA - Light-gray, locally bleached, medium-grained, equigracular, hornblende-biotite quartz conzonite to granodicrite. Post River Intrusive is highly porphyritic and contains euhedral phenocrysts of orthoclase whereas Bowser Creek stock is dominantly intrusive breccia with clasts ranging in sire from centimeters to meters. Locally igneous breccias can be classified as true breccia pipes that can exceed 100 cm in length. K-Ar age of 61.8 m.y. obtained from Post River pluton (table 1). Xenoliths of a more mafic phase abundant in the Post River body. Volumetrically significant and distinctive zones of sedimentary and igneous breccia (br cr. pl. 1).

Tia ANDESITE-TRACHYANDESITE SILLS AND DIKES - Green-gray, fine-grained, hypidiomorphic-granular, occasionally porphyritic andesitic sills and dikes up to 20 m thick, often subparallel to primary foliation; up to 80 percent andesine (commonly very altered), up to 20 percent alkali feldspar, and highly altered hornblende, biotite or pyroxene or both. Alteration minerals are chlorite, carbonate, opaques, and white mica; apatite is a common accessory mineral; fine-grained disseminated pyrite present locally. Contact effects rarely seen in adjacent country rock but metalliferous skam and breccia-pipe mineralization is exposed near Bar-ser Creek in the study area and in the Veleska Lake area to the north (Bundtzen, Kline, and Clough, 1982). Tia unit may include some feisic and basaltic dikes. Assigned to Tertiary because of K-Ar dating to the north in McGrath E-2 Quadrangle (Solie and others (1982). Some dikes are shown schematically on geologic map.

Tids INTRUSIVE DIKE SWARM - Subparallel swarm of predominantly andesitic dikes with several felsic and mafic dikes (units Tia. Tif, and Tim, undivided?); includes slivers of Paleozoic strata that commonly show minimal to extreme hornfelsing and silicification. In western portion of map area Tids forms an enormous 6 km wide by 10 km long zone that extends an additional 15 km into the McGrath A-3 Quadrangle described by Gilbert and Solie (1983).