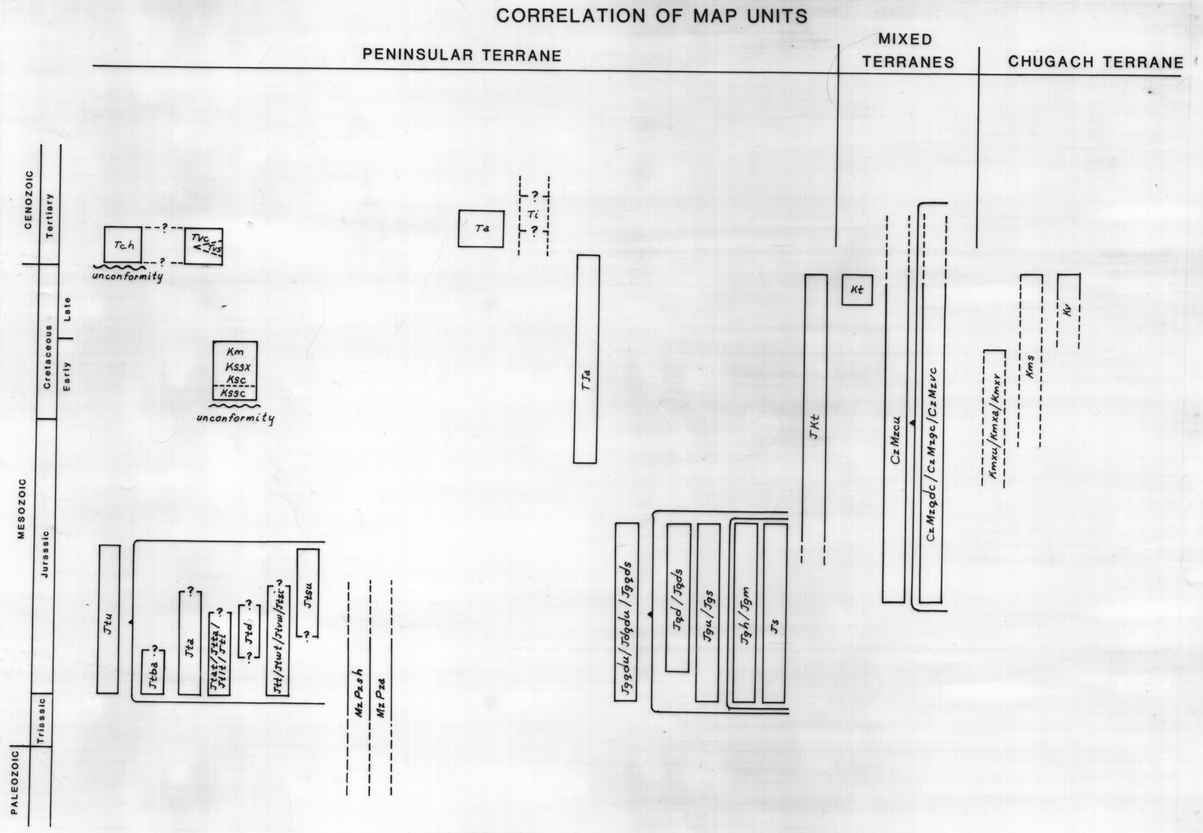
EXPLANATION

CORRELATION OF MAP UNITS



GEOLOGIC MAP SYMBOLS

Contact: Long-dash where approximate, short dash where inferred, dotted where concealed by overlying units, and queried where speculative.

Fault: Long dash where approximate, short dash where inferred, dotted where concealed by overlying units, and queried where speculative. U: upthrown side, D: downthrown side, half arrows show sense of lateral movement. Arrow shows direction and amount of dip.

Low-angle fault: Long dash where approximate, short dash where inferred, dotted where concealed by overlying units, and queried where speculative. Teeth on upper plate.

Dike swarm: Indicates an area of abundant intermediate and mafic dikes. Orientation of dike swarm shown as much as possible, but symbol is diagrammatic.

Chaotically mixed intrusive rocks: Complex intrusive mixture of mafic and intermediate plutonic rock.

Pyritized zone in Talkeetna Formation: Zone of abundant limonitic staining and pyritic alteration of Talkeetna Formation (Jtu).

Folds: Showing axial trace and direction of plunge. Long dash where approximate, short dash where speculative, dotted where concealed by overlying units, and queried where speculative.

Anticline

Syncline

Overturned anticline

Strike and dip of planer surfaces

Bedding, not necessarily upright

Bedding not measured, showing approximate direction and amount of strike and dip.

Bedding, overturned.

Flow foliation or compositional layering in plutonic rocks; schistocity or cleavage in metamorphic rocks.

Mafic or intermediate dike.

DESCRIPTION OF MAP UNITS

QUATERNARY UNITS

Qu — QUATERNARY DEPOSITS, UNDIFFERENTIATED-- Includes stream deposits, colluvium, talus, alluvial fans, landslides, and glacial deposits.

Qst — STREAM DEPOSITS-- Mostly braided stream deposits; chiefly cobbly and pebbly gravel, coarse to fine sand, silt, swamp deposits, and peaty materials.

Qc — COLLUVIUM DEPOSITS-- Surficial slope deposits, largely covered by alpine tundra and brush. Solifluction lobes, soil-creep deposits, vegetated talus deposits, and till deposits are included.

Qt — TALUS DEPOSITS-- Rubble aprons composed of angular clasts from grit to boulders, unvegetated.

Qaf — ALLUVIAL FAN DEPOSITS-- Bedded and sorted fan deposits; mostly unconsolidated coarse conglomerate, sand, and silt. May include some vegetated talus deposits.

Qls — LANDSLIDE DEPOSITS-- Landslide and slump deposits; typically exhibit hummocky topography and pull-away scarps at upper margins. Many landslides are associated with tectonic slices of the Chickaloon Formation in areas where there is evidence of recent movement on high-angle faults. Older landslides are heavily vegetated.

Qrg — ROCK GLACIERS-- Lobate rock glaciers composed of blocky rubble from surrounding ridges and peaks. Most rock glaciers are located in north-facing cirques and are currently active.

Qm — GLACIAL DEPOSITS-- Undifferentiated glacial deposits, mostly moraines, including lateral, medial, and end moraines. Outwash deposits and kame terraces are included in the unit, but have not been differentiated.

Qg — GLACIAL ICE-- Modern glaciers.

BEDROCK

Tch — CHICKALOON FORMATION-- Clastic sedimentary rocks of fluvial origin. Consists generally of thick-bedded, moderately indurated sediments, including conglomerate, sandstone, siltstone, and mudstone. Fine-grained deposits are characteristically carbonaceous, and coal is common in some parts of the formation.

Thick, tabular beds of brown or black carbonaceous mudstone (mostly swamp deposits) are rhythmically intercalated with scour-based sequences of coarse clastic sedimentary rock (channel deposits). Some mudstone beds exceed 10 m in thickness, and the formation contains more mudstone and shale than coarser clastic rocks. Some mudstones contain numerous leaf impressions and coalified and silicified wood, including logs, one of which was observed in growth position. Mudstone sequences contain uncommon beds of silty sandstone and siltstone that are possibly flood deposits.

Channel deposits, which are the coarser grained sequences, consist chiefly of medium- to thick-bedded, sandy, pebble or granule conglomerate and cross-bedded, coarse- to medium-grained feldspathic and lithic sandstone. Scoured surfaces are common. Clasts are chiefly rounded fragments of gray chert, but include abundant andesitic volcanic rocks and minor amounts of red radiolarian chert. Clasts of argillite, phyllite, and greenstone are rare. The coarsest clastic rocks, including cobble conglomerate, occur mainly in the lower part of the unit.

In the northwestern corner of the Anchorage C-3 Quadrangle, the Chickaloon Formation unconformably overlies the Talkeetna Formation (Jtsu) with pronounced angular discordance. In this location, the basal part of the Chickaloon Formation contains abundant clasts of the underlying Talkeetna Formation. In most of the map area, the basal unconformity seems to be approximately coincident with a low-angle detachment fault that has been folded. Elsewhere, tectonic slices of the Chickaloon Formation are bounded by high- and low-angle faults, and the formation is broadly to tightly folded on a large scale. Adjacent to major faults, sandstone beds are boudinaged, and dacite (Ti) dikes and sills commonly intrude the fault zones.

In the Matanuska Valley, the Chickaloon Formation disconformably overlies (Waring, 1936; Barnes and Payne, 1956) the Matanuska Formation of Late Cretaceous age (Grantz, 1964). Thus the Chickaloon Formation may have been deposited across a block-faulted basement consisting of uplifted Talkeetna Formation to the south, in the area of the present northern Chugach Mountains, and down-dropped Matanuska Formation to the north, in the area of the present Matanuska Valley.

The Chickaloon Formation is considered to be of Paleocene age (Fisher and Magoon, 1978).

Tvc — CONGLOMERATE-- Poorly sorted cobble to boulder conglomerate, generally massive to crudely stratified in very thick beds (10 m), with subangular to subrounded clasts. Clasts include gray chert, andesite, tuff, red chert, and gabbroic/dioritic rocks. Mafic plutonic clasts are locally abundant. Contains the most angular clasts near its southern limit and becomes more stratified to the north, with less massive bedding.

Distinguished from the Chickaloon Formation (Tch) by the presence of a green chloritic matrix and the lack of well-defined stratification. May be a coarse, basal sequence or lateral equivalent of the Chickaloon Formation. However, the unit is generally fault-bounded, and its stratigraphic relationship to the Chickaloon Formation (Tch) has not been established.

Tvs — CONGLOMERATE AND SANDSTONE-- Cobble and pebble conglomerate, similar to unit Tvc, but finer-grained, more stratified, and interbedded with green-weathering sandstone. Sandstone and conglomerate are both greenish, with a chloritic matrix that was probably derived from a source that includes the Talkeetna Formation.

Distinguished from the Chickaloon Formation (Tch) by the presence of large amounts of chloritic material and the lack of buff-weathering sandstone, plant fossils, and carbonaceous sequences that are more typical of the Chickaloon Formation. May be a localized facies of the Chickaloon Formation. Unit is fault-bounded and its stratigraphic relationship to other Tertiary sedimentary units is uncertain.

Km — MATANUSKA FORMATION-- Claystone and siltstone with limestone concretions. Lower half is characterized by limestone concretions with cone-in-cone structure and very large, thick prismatic shells of INOCERAMUS cf. I. SCHMIDTI of Campanian age. In many places includes siltstone mapped elsewhere as (Kst). Contact with (Kst) is approximate. (description taken from Grantz, 1960)

Kssx — MATANUSKA FORMATION-- Pebbly sandstone (Cenomanian or Turonian in age. (description taken from Grantz, 1960)

Kssc — MATANUSKA FORMATION-- Siltstone, siltstone with graded sandstone beds, sandstone and conglomerate (Turonian). (description taken from Grantz, 1960)

Jtu — TALKEETNA FORMATION, UNDIFFERENTIATED-- Volcanic flows, hypabyssal intrusions, pyroclastic rocks, and volcaniclastic sediments of predominantly intermediate composition; conglomerate, graywacke, fossiliferous siltstone, sandstone, and intercalated volcanic and sedimentary rocks. Pervasively altered to fine-grained epidote-chlorite +/- calcite assemblages and locally veined with zeolites. Stippled pattern indicates abundant disseminated pyrite or limonite after pyrite. Discontinuous quartz-calcite-prehnite-epidote-chalcocite veins of apparent metamorphic derivation are occasionally found in mafic-volcanic members.

Jtsu — TALKEETNA FORMATION SEDIMENTS, UNDIFFERENTIATED-- Includes well-bedded, well-sorted sandstone and fossiliferous shale, typically intercalated on a medium scale (0.5 - 1 m) with volcaniclastic rocks.

Jtsc — TALKEETNA FORMATION CONGLOMERATE-- Well-bedded, partly cross-bedded conglomerate with 5 - 30 cm in diameter, rounded volcanic clasts in a silty or sandy matrix; occasionally fossiliferous.

Jtvw — TALKEETNA FORMATION, VOLCANIC WACKE-- Thick to thinly bedded, poorly to moderately sorted volcanic wacke. Dominantly clast-supported, with sub-rounded hand- to gravel-sized volcanic fragments in a sand- to silt-sized matrix. Matrix is typically altered to a soft, dark-gray-green assemblage, that includes chlorite, epidote, calcite, and zeolites.

Jtwt — TALKEETNA FORMATION, WATER-LAID TUFF-- Thinly laminated, green, gray, or brown, well-sorted and well-bedded tuff composed of subrounded to rounded sand to silt-sized volcaniclastic grains. Typically found in depositional contact overlying volcanic and ignimbritic portions of the Talkeetna Formation.

Jtt — TALKEETNA FORMATION, TUFF-- Undifferentiated water-laid tuff, poorly-sorted to well-sorted, with conglomeratic to sand-size clasts. Textures and bedding characteristics vary considerably along strike.

Jti — TALKEETNA FORMATION, IGNIMBRITE-- Undifferentiated, generally greenish-weathering ignimbritic tuffs, including crystal-, crystal-lithic, and vitric tuffs, that contain devitrified pumiceous clasts of variable size in an aphanitic groundmass. Includes tuff breccias (agglomerate) and ash tuff that are generally poorly sorted and poorly bedded.

Jtlt — TALKEETNA FORMATION, LITHIC TUFF-- Massive, light-green-weathering, ignimbritic lithic tuff, dominantly lapilli, but also includes tuff breccia. Unsorted, subrounded to angular lithic fragments (5 - 30 percent) are present in an aphanitic groundmass. Locally, compaction textures, including fragment flattening, are seen.

Jtklt — TALKEETNA FORMATION, CRYSTAL-LITHIC TUFF-- Light-green-weathering, ignimbritic lapilli tuff composed of 2 - 40 percent broken plagioclase phenocrysts and 1 - 30 percent angular to subrounded, aphyric or microporphyritic lithic (andesite?) fragments (1 - 5 mm) in an aphanitic groundmass. Unsorted and poorly bedded to massive.

Jtat-Jtta — TALKEETNA FORMATION, ANDESITE AND TUFF-- Medium-bedded and/or massive ignimbritic tuff, including lapilli and crystal-lithic tuff intercalated with andesite and less dacite. Occurrence of amygdaloidal and brecciated varieties and nonamygdaloidal varieties suggests that some of these units are volcanic flow or tuff units and others represent shallow andesitic sill or tuff complexes.

Jtc — TALKEETNA FORMATION, DACITE-- Siliceous, possibly silicified, brown-weathering, medium- to thinly bedded flows or hypabyssal intrusions, with 2 - 5 percent partly resorbed quartz phenocrysts, 5 - 15 percent plagioclase tablets, and 2 - 5 percent chloritized mafics. Locally, autoclastic structure occurs. Typically contains 0.5 - 5 percent disseminated pyrite cubes (1 - 3 mm).

Jta — TALKEETNA FORMATION, ANDESITE-- Dark- to medium-green-weathering andesite flows and hypabyssal intrusions with 10 - 20 percent, 1 - 2 mm oscillatory-zoned plagioclase tablets and 5 - 15 percent chloritized mafics (largely pyroxene) in a fine-grained groundmass. Includes several textural varieties: 1)medium-bedded amygdaloidal andesite porphyry, 2)glomeroporphyritic andesite with clots of mafic and feldspar crystals in a nearly aphanitic groundmass, 3)massive, porphyritic and subequigranular andesite, and 4)heavily chloritized and epidotized andesite. Some varieties closely resemble very fine grained diorite in texture and composition.

Jtba — TALKEETNA FORMATION, ERRATIC ANDESITE-- Dark-purple weathering, medium-bedded, slightly magnetic, highly amygdaloidal volcanic rocks with 10 - 20 percent plagioclase and 5 - 10 percent altered pyroxene phenocrysts in a very fine grained andesitic matrix. Also includes reddish-purple-weathering, blocky, scoriaceous basalt.

Jzmvc — MAFIC CATACLASITE, UNDIFFERENTIATED-- Chlorite-rich mafic cataclasite with waxy luster and characteristic scaly texture. Polished, fault surfaces are common. Appears to be formed during extreme cataclasis and retrograde alteration of gabbroic rocks, tonalite, quartz diorite, volcanics, and ultramafic rocks. Most rocks are so altered that protoliths are uncertain in hand specimen. Commonly veined with carbonate and laumontite, which form a white, powdery material on weathered surfaces. Alternating light and dark layers and a steeply dipping foliation are evident on some smooth surfaces and are probably the result of shearing and cataclastic differentiation.

Matrix is extremely fine-grained and consists of largely recrystallized(?) and lesser broken plagioclase +/- quartz crystals intergrown with abundant epidote and chlorite. Other alteration minerals are calcite, prehnite, local pumpellyite and local fibrous amphibole. Plagioclase porphyroclasts have bent albite-twin lamellae cut by microfaults and are variably recrystallized. May include metamorphosed cataclasites and foliated blastomylonites.

May represent a central part of the Border Ranges fault zone, where rocks from both the upper and lower plates were cataclastically deformed, metamorphosed, and tectonically intermixed.

Jzmgc — GABBROIC CATACLASITE-- Mafic cataclasite that appears to have a protolith of dominantly gabbroic and ultramafic rocks. Plagioclase crystals are commonly brown and contain deformation twins and bent albite-twin lamellae. Pyroxene crystals are also commonly broken and exhibit strain lamellae and undulate extinction. Alteration products of earlier retrograde metamorphism (cummingtonite-anthophyllite from orthopyroxene and clinozoisite from plagioclase) are overprinted by chlorite, epidote, prehnite, and pumpellyite, or fibrous amphiboles that formed during and/or after the cataclastic deformation. Pyrite is variably present as pseudomorphic replacement of magnetite. Locally, lithic clasts with a relict gabbroic texture and composition are present. Contact with gabbroic rocks (Jgu) is generally gradational.

Jzmqc — QUARTZ DIORITE CATACLASITE-- Mafic cataclasite appearing to have a protolith of dominantly tonalite-quartz diorite intruded by mafic dikes. Commonly contains a small amount of plagioclase porphyroclasts (1-2 mm diameter). Quartz porphyroclasts exhibit strain and are polygonized or partly recrystallized. Some dark green chloritic layers are 1 to 1 m thick and probably mafic dikes. Light-green, chloritic, quartzo-feldspathic layers are derived from tonalite-quartz diorite (Jqd). Contact with tonalite-quartz diorite (Jqd) is generally gradational.

Jzmvc — METAVOLCANIC CATACLASITE-- Mafic cataclasite appearing to have a protolith of dominantly metavolcanic rock. In the Anchorage C-1 Quadrangle (east of this report area), mafic cataclasite associated with pillow lava and radiolarian chert is probably derived from the McHugh Complex (Kmxu).

Jzmlm — MYLONITE-- Orange weathering (sideritic?), finely laminated, siliceous, carbonate-rich mylonite or protomylonite. Forms a discontinuous zone about 10 m thick, east of the Matanuska Glacier in the fault zone between the mafic cataclasite (Jzmzu) and the Valdez Group (Kv).

INTRUSIVE ROCKS

Ti — FELSITE-- Porphyritic hypabyssal dikes and small plugs of orange- or buff-weathering, light gray to beige rock of andesitic to dacitic composition, often containing up to 10 percent pyrite. Phenocrysts are predominantly plagioclase, with subordinate amounts of quartz and minor hornblende and/or biotite altering to assemblages of chlorite and calcite. Groundmass is felsitic. Hornblende gabbro and small quartz diorite intrusions are common. Minor amounts of partly or totally serpentinized ultrabasic, clinopyroxenite, websterite, and wehrlite are also present.

Metamorphism is extensive in the gabbroic rocks and progressed from low- to moderate-pressure granulite facies (calcic plagioclase-diopside-hypersthene +/- spinel +/-hornblende), to lawsonite-albite-chlorite-prehnite-pumpellyite facies (albite-epidote-chlorite-sphene), to greenschist facies (clinozoisite-epidote-chlorite-sphene and fibrous amphibole). Secondary calcite or later zeolites are also present in some rocks.

In the western Anchorage C-3 and the Anchorage C-4 Quadrangles (west of the main part of this report area), the unit is predominantly an altered pyroxene-hornblende gabbronorite. Augite is rimmed or replaced by dark-green hornblende and/or chlorite and fibrous amphibole. Hypersthene is completely replaced by a lamellar intergrowth of cummingtonite-anthophyllite that has commonly been partly or wholly replaced by calcite and clinozoisite. Unzoned plagioclase (bytownite) is clouded with very fine grained clinozoisite and fine-grained sericite. Other alteration minerals include calcite and prehnite. A common protoclastic(?) foliation is formed from alignment of plagioclase and hornblende crystals.

Unit is locally sheared and heavily zeolitized near fault zones. Disseminated pyrite is common in sheared gabbroic rocks in and near fault zones.

Jgw — FINE-GRAINED GABBRONORITE AND DIORITE-- Fine-grained gabbroic rocks, and fine-grained quartz-bearing hornblende diorite, with lesser amounts of medium- to very coarse grained gabbroic rocks (Jgu). Contact relations between the fine- and coarse grained rocks are commonly obscured, but some fine-grained dikes and small plugs clearly intrude coarser gabbroic rocks. Fine-grained rocks are mostly hornblende diorite containing minor amounts of quartz. Other fine grained rocks include hypersthene-hornblende gabbronorite (commonly containing 8 - 12 percent primary magnetite and ilmenite), and hornblende gabbro. Some fine-grained hornblende diorite contains plagioclase phenocrysts (1-2 mm diameter). Much fine-grained gabbro is altered to cummingtonite-anthophyllite + clinozoisite + epidote + chlorite + sphene + pyrite +/-calcite +/-zeolites.

Jgh — PYROXENE-HORNBLENDE GABBRONORITE-- Pyroxene-hornblende gabbronorite in large masses. Most rocks are relatively coarse grained, with large hornblende crystals, some up to several cm long. Lenticular masses of serpentinized ultramafic rock, including hornblendites and pyroxenite(?) are common in some parts of the unit.

Jgs — SHEARED GABBRONORITE-- Undifferentiated gabbronorite (Jgu) and associated ultramafic rocks that have been complexly faulted, sheared, and altered. Typically contains blocks and masses of relatively undeformed gabbroic rocks in a mass of sheared material whose protolith is unrecognizable. Strained pyroxene and broken and strained plagioclase, with little or no recrystallization are evidence of cataclastic deformation. Most rocks contain secondary chlorite +/-carpatite, pyrite, prehnite, fibrous amphibole, clinozoisite, epidote, calcite, sphene, and zeolite veins.

Contains some of the most intensely deformed rocks in the area; may be the result of deformation associated with underthrusting of the Chugach terrane in south-central Alaska.

Js — SERPENTINITE-- Serpentinized and partly serpentinized ultramafic rocks associated with the gabbroic rocks (Jgu). Protoliths include clinopyroxenite, wehrlite, harzburgite, and troctolite. Some chrysotile occurs in small masses in larger serpentinite bodies.

TJa — ANDESITE AND DACITE-- Altered dikes and sills of massive, light-grayish-green porphyritic andesite and porphyritic dacite that intrude the Talkeetna Formation (Jtu) and are gradational with fine-grained quartz diorite (Jqd). Porphyritic dacite contains about 7 percent euhedral to subhedral plagioclase phenocrysts (2 - 3 mm) and about 1 percent equant quartz phenocrysts (0.5 mm) in an aphanitic groundmass. Plagioclase phenocrysts are glomeroporphyritic and the groundmass is felted or allotriomorphic granular. Some fine-grained quartz diorite is slightly porphyritic and contains phenocrysts of euhedral plagioclase and subhedral quartz in a felted, micrographic, or allotriomorphic-granular groundmass. Hornblende is altered to chlorite. Other alteration products are epidote, phengite, calcite, and pumpellyite.

Unit generally occurs as a wide zone between tonalite-quartz diorite (Jqd) and the Talkeetna Formation (Jtu). Contacts between this unit, the tonalite-quartz diorite, and the Talkeetna Formation are commonly faulted. It is uncertain whether the relationship between this intrusive unit and the tonalite-quartz diorite is gradational or cross-cutting.

Ta — ANDESITE-- Andesite porphyry similar to unit (TJa). Assumed to be Tertiary in age because it intrudes some of the younger units, including the tonalite-quartz diorite (Jqd) and the mafic cataclasite (Czmzu). Also, chloritic alteration of the mafic minerals is relatively lacking, compared to older andesitic rocks.

Jqgds — SHEARED GABBRONORITE (Jgu), SHEARED ULTRAMAFIC ROCKS (Js), AND SHEARED TONALITE-QUARTZ DIORITE (Jqd), UNDIFFERENTIATED-- Undifferentiated plutonic rocks of mafic, ultramafic, and intermediate composition that have been pervasively fractured, sheared, and altered. Typically contains blocks of relatively undeformed crystalline rocks of gabbroic, quartz dioritic, and ultramafic composition in a mass of sheared and fractured material of unrecognizable protolith. Cataclastic structure is common. Most rocks contain secondary chlorite, serpentine, fibrous amphibole, epidote, and zeolite veins. In some areas, the zeolitization is so pervasive that the weathered surface of the rocks typically has a white, powdery appearance.

Jqd — TONALITE-QUARTZ DIORITE-- Medium-grained tonalite and quartz diorite. Typical tonalite and quartz diorite are light-gray weathering and composed of fine- to medium-grained subhedral plagioclase (40 - 60 percent), anhedral quartz (20 - 30 percent), and anhedral and poikilitic green hornblende (5 - 25 percent). Locally, some hornblende is partially altered to chlorite. Hornblende-biotite quartz diorite is also common. Most plagioclase is zoned and altered to clinozoisite and sericite. Apatite, iron-oxides, and sphene are common accessory minerals.

Small pods of medium- to coarse-grained granodiorite(?) with up to 10 percent microcline and 5 - 10 percent biotite are interpreted as late-stage differentiates. Some secondary potassium feldspar occurs as pinkish crystals in pegmatitic veins and as interstitial, fine-grained crystals in roof(?) zones of the tonalite.

Tonalite-quartz diorite occurs in large structural blocks and apparent plutons of relatively homogenous composition and texture. Within the gabbroic bodies (Jgu), tonalite occurs as small dikes and plugs. Field relations conclusively indicate that the tonalite-quartz diorite intrudes the gabbroic rocks. Intrusive contacts of tonalite-quartz diorite and gabbronorite are commonly complex. Abundant xenoliths of gabbroic rocks are common in the tonalite-quartz diorite.

Tonalite-quartz diorite typically displays an ambiguous relationship to the Talkeetna Formation (Jtu). Inclusions of Talkeetna Formation in tonalite-quartz diorite have been identified, and most contacts between the two units are faults. East of the Matanuska Glacier, in the Anchorage C-2 Quadrangle, a pluton of tonalite-quartz diorite clearly intrudes the Talkeetna Formation (Jtat). Near some contacts between the tonalite-quartz diorite and the Talkeetna Formation, the tonalite-quartz diorite is distinctly finer grained than usual and may be a chilled border phase. The Talkeetna Formation is also locally cut by andesitic and dacitic dikes (TJa) that may be related to the tonalite-quartz diorite intrusions.

Tonalite-quartz diorite is typically massive or very weakly foliated, particularly in the larger plutonic bodies. However, zones of highly foliated quartz diorite with an almost cataclastic texture occur locally and are probably the result of protoclastic deformation during or after emplacement.

Tonalite-quartz diorite is intruded locally by large numbers of dikes of the same composition. Generally fine grained porphyry but also dacite, andesite, and trondhjemite. In some areas, the dikes form up to 50 percent of the rock. Areas containing numerous dikes are shown by a dash-dot pattern superimposed on the map unit (see map symbols).

Jqcs — SHEARED AND FRACTURED TONALITE AND QUARTZ DIORITE-- Large zones of tonalite-quartz diorite (Jqd) that have been pervasively sheared and fractured. Structure typically consists of bodies of fractured tonalite-quartz diorite surrounded by finer grained cataclastic zones. Mafic minerals are almost entirely chloritized, and many of these rocks have been zeolitized, producing a characteristic white, powdery weathered surface.

Jgu — GABBRONORITE UNDIFFERENTIATED-- Fine- to coarse-grained, rusty-weathering gabbroic rocks consisting primarily of gabbronorite, leucogabbronorite, and pyroxene-hornblende gabbronorite with lesser amounts of anorthosite. Orthopyroxene ranges in composition from ferro-hypersthene to bronzite and is roughly equal in abundance to clinopyroxene. Clinopyroxene ranges in composition from diopside to salite and is commonly rimmed by pargasitic hornblende. Plagioclase is dominantly calcic bytownite with lesser anorthite and is unzoned. Some pyroxene-hornblende gabbronorite contains labradorite. The more magnesium- and calcium- rich gabbronorite commonly contains iron-rich pleonaste (green spinel), and several samples contain olivine surrounded by a corona of orthopyroxene surrounded by clinopyroxene or hornblende and iron-rich pleonaste.

Primary magnetite and ilmenite commonly form 8 - 15 percent of the pyroxene-hornblende gabbronorite and are also abundant (4 - 8 percent) in the hornblende gabbro. Hornblende gabbro and small quartz diorite intrusions are common. Minor amounts of partly or totally serpentinized ultrabasic, clinopyroxenite, websterite, and wehrlite are also present.

Metamorphism is extensive in the gabbroic rocks and progressed from low- to moderate-pressure granulite facies (calcic plagioclase-diopside-hypersthene +/- spinel +/-hornblende), to lawsonite-albite-chlorite-prehnite-pumpellyite facies (bytownite-diopside-cummingtonite-anthophyllite-chlorite-epidote-prehnite-pumpellyite), to greenschist facies (labradorite-epidote-clinozoisite-hornblende-sphene), to greenschist facies (clinozoisite-epidote-chlorite-sphene and fibrous amphibole). Secondary calcite or later zeolites are also present in some rocks.

In the western Anchorage C-3 and the Anchorage C-4 Quadrangles (west of the main part of this report area), the unit is predominantly an altered pyroxene-hornblende gabbronorite. Augite is rimmed or replaced by dark-green hornblende and/or chlorite and fibrous amphibole. Hypersthene is completely replaced by a lamellar intergrowth of cummingtonite-anthophyllite that has commonly been partly or wholly replaced by calcite and clinozoisite. Unzoned plagioclase (bytownite) is clouded with very fine grained clinozoisite and fine-grained sericite. Other alteration minerals include calcite and prehnite. A common protoclastic(?) foliation is formed from alignment of plagioclase and hornblende crystals.

Unit is locally sheared and heavily zeolitized near fault zones.

Jqgd — FINE-GRAINED GABBRONORITE AND DIORITE-- Fine-grained gabbroic rocks, and fine-grained quartz-bearing hornblende diorite, with lesser amounts of medium- to very coarse grained gabbroic rocks (Jgu). Contact relations between the fine- and coarse grained rocks are commonly obscured, but some fine-grained dikes and small plugs clearly intrude coarser gabbroic rocks. Fine-grained rocks are mostly hornblende diorite containing minor amounts of quartz. Other fine grained rocks include hypersthene-hornblende gabbronorite (commonly containing 8 - 12 percent primary magnetite and ilmenite), and hornblende gabbro. Some fine-grained hornblende diorite contains plagioclase phenocrysts (1-2 mm diameter). Much fine-grained gabbro is altered to cummingtonite-anthophyllite + clinozoisite + epidote + chlorite + sphene + pyrite +/-calcite +/-zeolites.

Jgh — PYROXENE-HORNBLENDE GABBRONORITE-- Pyroxene-hornblende gabbronorite in large masses. Most rocks are relatively coarse grained, with large hornblende crystals, some up to several cm long. Lenticular masses of serpentinized ultramafic rock, including hornblendites and pyroxenite(?) are common in some parts of the unit.

Jgs — SHEARED GABBRONORITE-- Undifferentiated gabbronorite (Jgu) and associated ultramafic rocks that have been complexly faulted, sheared, and altered. Typically contains blocks and masses of relatively undeformed gabbroic rocks in a mass of sheared material whose protolith is unrecognizable. Strained pyroxene and broken and strained plagioclase, with little or no recrystallization are evidence of cataclastic deformation. Most rocks contain secondary chlorite +/-carpatite, pyrite, prehnite, fibrous amphibole, clinozoisite, epidote, calcite, sphene, and zeolite veins.

Contains some of the most intensely deformed rocks in the area; may be the result of deformation associated with underthrusting of the Chugach terrane in south-central Alaska.

Js — SERPENTINITE-- Serpentinized and partly serpentinized ultramafic rocks associated with the gabbroic rocks (Jgu). Protoliths include clinopyroxenite, wehrlite, harzburgite, and troctolite. Some chrysotile occurs in small masses in larger serpentinite bodies.

TJa — ANDESITE AND DACITE-- Altered dikes and sills of massive, light-grayish-green porphyritic andesite and porphyritic dacite that intrude the Talkeetna Formation (Jtu) and are gradational with fine-grained quartz diorite (Jqd). Porphyritic dacite contains about 7 percent euhedral to subhedral plagioclase phenocrysts (2 - 3 mm) and about 1 percent equant quartz phenocrysts (0.5 mm) in an aphanitic groundmass. Plagioclase phenocrysts are glomeroporphyritic and the groundmass is felted or allotriomorphic granular. Some fine-grained quartz diorite is slightly porphyritic and contains phenocrysts of euhedral plagioclase and subhedral quartz in a felted, micrographic, or allotriomorphic-granular groundmass. Hornblende is altered to chlorite. Other alteration products are epidote, phengite, calcite, and pumpellyite.

Unit generally occurs as a wide zone between tonalite-quartz diorite (Jqd) and the Talkeetna Formation (Jtu). Contacts between this unit, the tonalite-quartz diorite, and the Talkeetna Formation are commonly faulted. It is uncertain whether the relationship between this intrusive unit and the tonalite-quartz diorite is gradational or cross-cutting.

TJa — ANDESITE-- Andesite porphyry similar to unit (TJa). Assumed to be Tertiary in age because it intrudes some of the younger units, including the tonalite-quartz diorite (Jqd) and the mafic cataclasite (Czmzu). Also, chloritic alteration of the mafic minerals is relatively lacking, compared to older andesitic rocks.

TJu — TALKEETNA FORMATION (Jtu), ANDESITE AND DACITE DIKES (TJa), AND TONALITE-QUARTZ DIORITE (Jqd), UNDIFFERENTIATED-- Faulted complex in area east of Gravel Creek, near the northern front of the Chugach Mountains (Anchorage C-2 Quadrangle) that contains these units in a terrain that is not accessible.

METAMORPHIC ROCKS OF THE PENINSULAR TERRANE

MzPzsh — SCHIST-- Metamorphic rocks of various types, including gray carbonaceous phyllite, biotite-muscovite-quartz schist, garnetiferous biotite-plagioclase-quartz schist, quartzite (metachert), siliceous marble, and weakly foliated greenschist. Also includes chlorite-actinolite-biotite-quartz schist, and muscovite-biotite-chlorite-actinolite-clinozoisite-quartz schist, which both contain minor plagioclase and calcite. Protolith of the latter rocks was possibly fine-grained tuffaceous sediment. Mineral assemblages suggest metamorphism at middle- to upper- greenschist facies. May be part of the metamorphic sequence of epidote-amphibolite and amphibolite-facies metamorphic rocks (MzPza), but this relationship has not been established. Tentatively assigned to the Peninsular terrane, but such an assignment is speculative.

MzPzm — MARBLE-- Laminated, fine-grained marble in discontinuous layers up to several m thick. Contains variable amounts of siliceous and argillaceous material (quartz and sericite). Interlayered with schist (MzPzsh) and is apparently part of that metamorphic sequence.

Sandra Clark (1978) collected Permian-age fusulinids from marble in a probable correlative metasedimentary sequence near Eklutna, west of the map area.

MzPza — AMPHIBOLITE AND SCHIST-- Dark, rusty brown weathering, fine-grained epidote-amphibolite-facies and lesser amphibolite-facies metamorphic rocks, including muscovite-bearing amphibolite gneiss and schist. In addition to amphibolite, much of the unit consists of metatuff and/or metagraywacke (epidote-bearing biotite-hornblende-plagioclase-quartz schist) that is thinly intercalated with lesser amounts of metamorphosed siliceous sediment (calcareous biotitic metachert and epidote-bearing garnet-muscovite-biotite-quartz schist +/-hypersolasei). Also includes some garnet-pyroxene-wollastonite calc-silicate granofels and marble. Gneissic amphibolites contain isoclinally folded trondhjemitic layers (about 1 cm thick) of possible anatectic origin. Quartz and sphene are common accessories in the amphibolite.

West of the map area, near King Mountain in the Anchorage C-4 and C-5 Quadrangles (Pavlis, 1982), similar rocks are intruded by gabbroic and dioritic rocks and are locally altered to skarn. Pyrite-chalcopyrite-pyrrhotite bearing amphibolite is also common near King Mountain.

Protolith of these rocks is uncertain, but the association of large bodies of marble and calc-silicate rocks with quartz schists indicates that the protolith is, at least in part, a sequence of sedimentary rock, including argillaceous carbonate, cherty argillite, and graywacke and/or tuff. Some blastoporphyritic amphibolite was probably basaltic flows.

CHUGACH TERRANE BEDROCK

Kv — VALDEZ GROUP-- Gray phyllite, gray-green chloritic phyllite, and thin- to very thick bedded metagraywacke. Phyllite contains abundant quartz segregations and veins and is locally calcareous. Graywacke sequences are thin bedded and appear to be turbidites. Near the northern boundary of the unit in the vicinity of major faults, the unit contains discontinuous zones of finely laminated calcareous mylonite and phyllonite(?).

Very sparse marine megafossil collections from the Valdez Group (elsewhere in the Chugach Mountains) are all indicative of a Late Cretaceous(Maestrichtian) depositional age (Jones and Clark, 1973). In the Valdez Quadrangle, metamorphism in the Valdez Group occurred soon after deposition, as indicated by a 53.5+/-1.6 m.y. whole-rock K/Ar age on a metatuff sample and a 51.6+/-1.5 m.y. white-mica K/Ar age on a post-metamorphic granitic stock (Winkler and others, 1981).

In the eastern part of the report area, the unit clearly resembles sedimentary rocks of the Valdez Group elsewhere in the Chugach Mountains (Clark, 1972) and includes phyllites, graywackes, and low grade metasediments. West of the Gravel Creek area (Anchorage C-3 Quadrangle), the distinction between the Valdez Group and the McHugh Complex is not obvious, and other units have been defined for this preliminary report. The boundary between the Valdez Group (Kv) and similar, but not so distinctive rocks (Kms) along the same structural and stratigraphic trend is arbitrary.

Kms — PHYLLITE AND ARGILLITE-- Predominantly gray phyllite, argillite, and thin to thick-bedded graywacke with minor graphitic siliceous phyllite and greenstone. Rare occurrences of graded beds, flute marks, and mud chip "rip-up" clasts suggest that the graywacke sequences were deposited by turbidity currents.

Rocks in this unit are highly deformed and are characterized by a penetrative phyllitic cleavage. Three deformation events are recognized (see structural characteristics, below).

This metasedimentary unit (Kms) is faulted against the metavolcanic unit (Kmxu) and the undifferentiated metasedimentary and metavolcanic unit (Kmxu) along an intersecting network of thrust and high-angle faults. Structural trends on both sides of this fault zone appears to be similar. South of the fault zone, metavolcanic rock is rare to the north, greenish metavolcanic rock is interlaminated and chaotically intermixed with metasedimentary rocks. Locally, the fault zone is difficult to identify because of similarities in appearance of the rock types on both sides.

Structural Characteristics:

The first deformation produced a phyllitic cleavage with abundant thin quartz segregations parallel to the cleavage (S1). Bedding is not commonly preserved, but where seen is subparallel to the first cleavage (S1). Small-scale isoclinal folds (F1) have axial planes parallel to the first cleavage (S1).

A second deformational event is evident mainly in the area between Gravel Creek and the Matanuska Glacier. The cleavage resulting from the first deformational event (S1) is folded into isoclines that are associated with an axial planar cleavage (S2). S2 is predominantly a spaced (crenulation?) cleavage, but is locally penetrative and breaks along micaceous surfaces. This cleavage is the predominant foliation (S2) seen in many outcrops.

The third deformation event is most evident between Glacier Creek and Gravel Creek in the Anchorage C-3 Quadrangle, where the cleavage from the second deformational event (S2) is folded into generally open and locally asymmetric recumbent folds. A spaced cleavage is locally axial planar to these folds. A large upright F3 fold in the Gravel Creek region is a faulted chevron-style antiform with a half-wavelength in excess of 2 to 3 km. This event is delineated by feldspar porphyrite (Ti) sills, which intrude the foliation plane (S2) of the second structural event. The sills produce a white banding in the dark rocks, visible from several km. Narrow, discontinuous zones of unsystematic structural deformation characterized by a pervasive, anastomosing fracture system occur locally and are probably the result of postmetamorphic faulting.

Kmxu — METASEDIMENTARY AND METAVOLCANIC ROCKS, (MCHUGH COMPLEX?), UNDIFFERENTIATED-- Chaotically intermixed dark-gray argillite and gray-green metavolcanic rock (mafic rock complex), thinly interlaminated gray