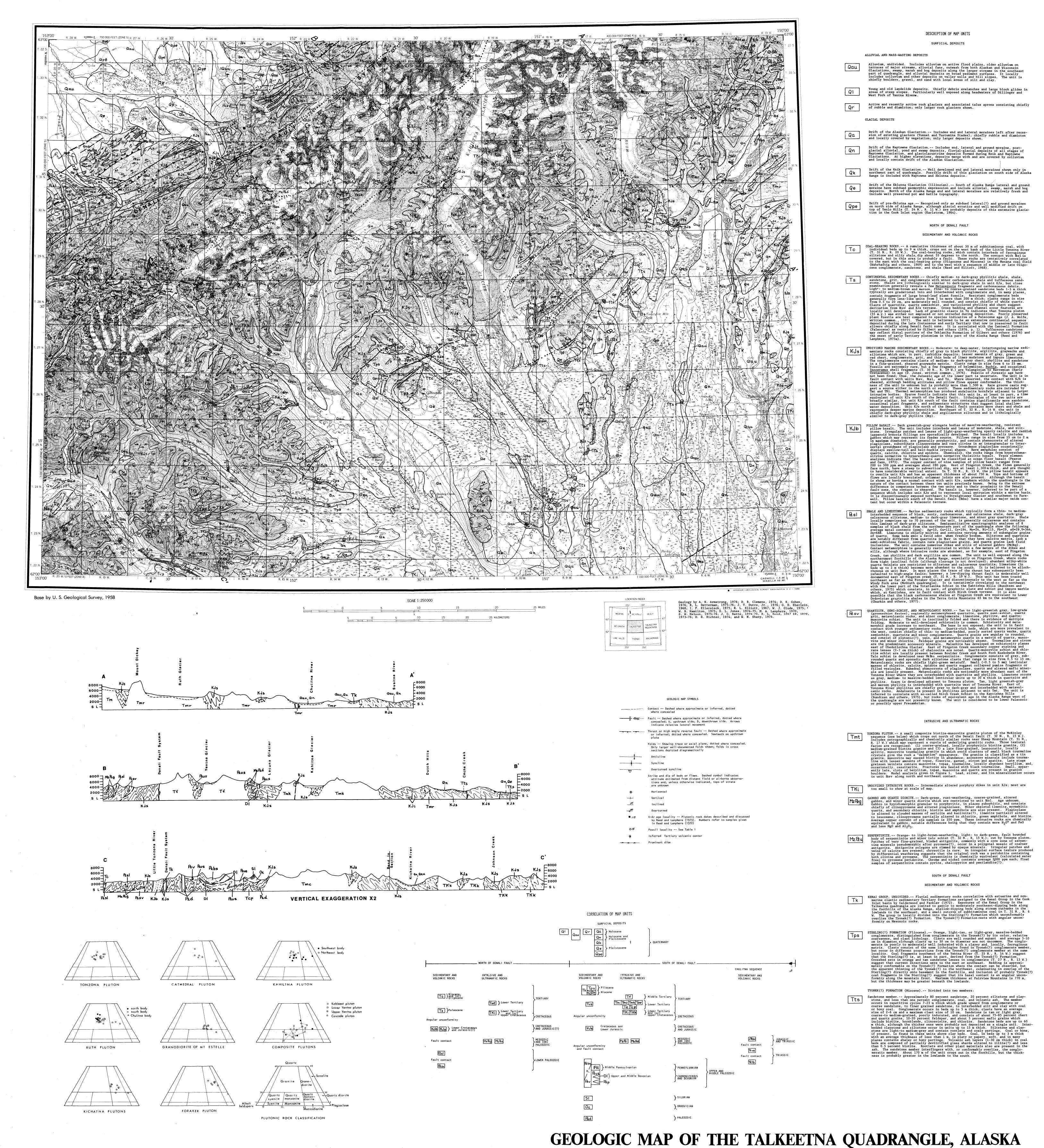
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B. L. Reed and S. W. Nelson

Conglomerate member. -- At Fairview Mountain (T. 26 N., R. 12 W.), at least 40 percent conglomerate, 20 percent sandstone and less than 40 percent siltstone, claystone, and coal. Conglomerate is light brown, light gray, or bluish gray, and poorly indurated. It occurs as massive beds up to 25 m thick. Clasts are smooth and well rounded and average 5 to 10 cm in diameter, with maximum size about 15 cm. The greatest number of chert and quartz clasts is found at Nakochna River; fewer are found to the northeast. Igneous clasts reach a maximum abundance at Fairview Mountain. The proportion of shale and graywacke clasts steadily increases from Nakochna River to more than 90 percent at Ruth Glacier. Sandstone is coarse, poorly sorted and pebbly, and is very poorly indurated. Siltstone, claystone, and coal occur as interbedded units which grade upward from sandy siltstone, to silty claystone, to coal. Coal beds range in thickness from 0.5 to 17 m but average 0.6-3 m thick. Coal is subbituminous, dull, black or brownish black, and contains clay or bone partings. One bed near the Nakochna River (Sec. 7, T. 24 N., R. 15 W.) is partially burned. UNDIVIDED VOLCANIC AND SEDIMENTARY ROCKS. -- Interbedded tuffs, mafic volcanic flows, sandstone, shale and minor calcareous mudstone. Volcanic rocks are chiefly mediumto coarse-grained, greenish-gray crystal lithic lapilli tuffs and volcanic rubble flows in units up to 150 m thick. Tuffs are composed of broken euhedral crystals of plagioclase with oscillatory zonation, serpentinized olivine, quartz and lapilli-sized fragments of crystal tuff in a brownish, slightly devitrified matrix. Lapilli fragments contain altered plagioclase, amphibole and minor biotite. Tuffs are locally pyritized; eU content of four samples averages 25 ppm; minor uranium prospecting occurred in 1954 and in 1976. Interbedded with tuff is well-sorted, lithic sandstone composed of angular clasts of dark chert, metamorphic, and rare volcanic rocks, and angular grains of quartz and plagioclase, with minor amounts of muscovite; calcite and chlorite form the interstitial cement. Shale and siltstone contain fragmentary plant remains. The source area for volcanic rocks is believed to be Round Mountain, 10 km to the northwest (T. 23 N., R. 19 W.). The volcanism is probably related to early or middle Tertiary plutonism in this part of the Alaska Range (Reed and Lanphere, 1973a). UNDIVIDED MARINE SEDIMENTARY ROCKS. -- Medium— to dark-gray, generally isoclinally folded, thick sequence of lithic graywacke, phyllite and shale with local lenses of quartz-chert conglomerate. The unit includes minor fossiliferous limestone, radiolarian chert and red ferruginous sandstone and siltstone. Lithic graywacke is thin to massive bedded, and locally shows graded bedding, ripple marks, cross bedding and pull apart structures. Graywacke is poor to moderately well sorted, and consists of angular to subangular, fine to coarse sand-sized detritus of which quartz and lithic fragments comprise about 50 percent. Lithic fragments are fine-grained recrystallized quartzite or metachert with lesser amounts of dark siltstone/argillite, muscovite schist and fine-grained volcanic rocks (including porphyry). Plagioclase, potassium feldspar and detrital muscovite are subordinate. Common, although not abundant, heavy minerals include zircon and tourmaline. Graywacke from the Yenlo Hills (T. 23 and 24 N., R. 11 W.) is significantly different in that the grains are extremely angular, and oscillatory zoned plagioclase, volcanic rock fragments, hornblende, epidote and calcite grains are more abundant, suggesting that the sandsone may have been derived from the Jurassic magmatic arc (Reed and Lamphere, 1973b) which is now covered by younger rocks in Cook Inlet Basin. Contemporaneous volcanism is suggested by rare interbedded, light-colored, tuffaceous sediments in the Yenlo Hills. Argillaceous rocks are locally thermally metamorphosed to spotted cordierite and andalusite hornfels. Graywacke is thermally metamorphosed to biotite quartz hornfels. Elsewhere, low grade metamorphism is indicated by the presence of metamorphic chlorite and biotite. Hydrothermal activity, probably related to emplacement of plutonic rocks at depth, locally has altered the graywackes to a soft orange-weathering quartz, chlorite, sericite, ironoxide rock which locally contains vuggy and brecciated quartz. Gold can usually be panned from streams drain found, a late Cretaceous age can not be ruled out. On the north side of the Tatina River reddish-brown-weathering sandstone and dark-gray shale contain Early Jurassic ammonites, brachiopods and pelecypods (R. Imlay, written commun., 1977). To the west, in the McGrath quadrangle (T. 26 N., R. 21 W.), these rocks include minor pillow basalt and volcanic flows. In most places the Early Jurassic rocks are in fault contact with the sedimentary rocks of the Dillinger River (Pzd), although in T. 27 N., R. 20 W. the contact is an angular unconformity. The contact relation of the Early Jurassic to Cretaceous strata is uncertain. The thickness of the unit is unknown but is probably more than 3,000 m. CONGLOMERATE OF MOUNT DALL. -- Informal name given to dark-brown to yellowish-brown-weathering sequence of conglomerate, sandstone, siltstone, and shale mainly of continental origin that forms a broad, open, east-plunging syncline. This unit is chiefly massive lenticular beds of conglomerate and sandstone with numerous cut and fill channels. Conglomerate forms beds up to 40 m thick; clasts range in size from 2 to 30 cm and are chiefly gray limestone and black chert. Limestone clasts contain Middle Devonian(?) fossils (W. A. Oliver, Jr., written commun., 1975) similar to those in Devonian limestone (Dl). Uncommon red and green chert, chert-pebble conglomerate, and graded sandstone clasts also suggest a Eus source. No granitic or volcanic clasts were recognized. Sandstone beds are commonly 2-3 cm thick and have well-developed planar and trough cross bedding and slump structures suggestive of fluvial deposition. Shale amd sandstone beds 3-5 m thick locally contain abundant plant fossils of Middle Pennsylvanian age (S. Mamay, written commun., 1977). Conglomerate is locally bleached grayish white due to hydrothermal alteration associated with intrusive rocks (Tcp). Limestone clasts are altered to cream-colored and light-green diposide, idocrase, wollastonite, quartz and calcite. This unit appears to be gradational downward to lithologically similar conglomerate in unit Eus which does not contain vari-colored chert clasts, is interbedded with shales that contain abundant worm trails, and in which limestone clasts are subordinate. The base of the unit consists chiefly of which limestone clasts are subordinate. The base of the unit consists chiefly of thickness of at least 1,500 m is present near Mount Dall. UNDIVIDED SEDIMENTARY ROCKS. -- A depositionally and structurally complex terrane of chiefly marine flyschoid sedimentary rocks which include (1) trench assemblages (and possibly intra-oceanic arc deposits) characterized by terrigenous turbidites, cherty pelegites and basaltic pillow lavas (all of which underwent complex undersea sliding and later multiple thrusting and folding), (2) slope and shelf assemblages which include chert, shale, reefoid limestone and, locally, terrestrial conglomerate and redbeds, and (3) a thick, locally terrestrial conglomerate and sandstone assemblage. These dissimilar middle and late Paleozoic depositional environments are now juxtaposed by large dislocated nappes and thrust faults on all scales. Structural features generally show a westerly vergency. The structural and stratigraphic relations of the contrasting rock types are known in only a few places. This terrane is allochthonous on unit Ed, truncated on north by Denali fault, fault bounded on the south by unit KJs, intruded by dunite and associated ultramafic rocks (MEDd) along southern contact with unit KJs, and elsewhere by units TKi, Tcp and the middle Tertiary Foraker pluton (Tf). Intrusive rocks of McKinley sequence (Reed and Lanphere, 1973a) and calc-alkaline volcanic and intrusive rocks of Paleozoic age are notably absent. For convenience, these rocks are described in units that were locally recognized in the field; however, none of these units are differentiated on the geologic map. The unit locally includes thin pillow basalt (Ebs), discontinuous and tectonically emplaced limestone beds (D1) and conglomerate of Mount Dall (Pd). The base of the terrane was not recognized; the thickness is unknown, but believed to be in excess of 2,500 m. Flysch deposits, believed to occur both above and below units &bs and Psv, are characteristic of the terrane and consist of graywacke, shale, phyllite, grit, chertpebble conglomerate, mudstone, chert, various types of volcanogenic sediments, wildflysch, and minor bioclastic limestone. Wildflysch locally contains house-sized blocks of bedded limestone (Dl, or Early to Middle Devonian limestone units locally present in unit Eus) chaotically distributed in volcanogenic mudstone and is spatially associated with pillow basalts. Graded beds and slump folds are common. Worm trails are characteristic of the finer grained sediments. Clastic limestone beds (T. 29 N., R. 19 W.) contain echinoderm remains that suggest a late Early or early Middle Devonian age (J. T. Dutro, Jr., written commun., 1975) for the limestone. Slope, shelf, and fluvial deposition is indicated by a 0- to 10-m-thick redbed sequence of sandstone and conglomerate which contains plant and coalified wood debris. The redbeds are overlain by 125-250 m of sandstone, siltstone and shale followed in turn by 60-90 m of locally reefoid limestone (DI). The limestone is overlain by an unknown thickness of black shale and phosphatic chert that locally contains distinctive spheroidal concretions ("blackballs") of fluorapatite. The locally abundant fauna from the clastic rocks and limestone indicates a late Middle and early Late Devonian age (J. T. Dutro, Jr., and W. A. Oliver, Jr., written commun., 1975, 1976). Massive-bedded chert-limestone conglomerate, sandstone and shale, in part terrestrial, is thought to be gradational downward into graywacke, shale, grit, minor pillow basalt and local beds of echinoderm-pellet limestone and lime mudstone of Late Mississippian and Middle Pennslyvanian age (A. K. Armstrong, written commun., 1976). The chert-limestone conglomerate and sandstone is gradational upward to the nonmarine conglomerate of Mount Dall of Middle Pennslyvanian age. PHYLLITE.-- Prominent unit of dark-gray phyllite, phyllitic shale and argillaceous silt-stone which lithologically is very similar to the phyllitic shale in the unit KJs both north (T. 33 N., R. 13 and 14 W.) and south (T. 26 N., R. 20 W.) of the Denali fault. The contact relation with unit Ezus is unknown but appears to be gradational southwest of Pingston Creek (T. 29 N., R. 19 W.); the unit may be allochthonous KJs. It contains worm trails which are abundant in unit Ezus but are also locally present in unit KJs south of the Denali fault (T. 26 N., R. 20 W.). LIMESTONE. -- Middle and Upper Devonian limestone near Shellabarger Pass is in excess of 95 m thick. On the West Fork of the Yentna River (T. 29 N., R. 18 W.) the base of the limestone is transitional with yellow to dark gray siltstones and shales. The lower 10 m are thin-bedded gray micrites which grade upward into fossiliferous, massive to 40 to 60 m above the base of the limestone, the beds are composed of a reefoid mass of colonial rugose corals, ramose and mamelons of large stromatoporoids. At 60 m, the limestone becomes more arigllaceous, thinner bedded, less fossiliferous and is composed of micrites. Thin (5- to 15-cm) dark-gray shale beds between limestone beds are common. A massive micritic, poorly fossiliferous gray limestone is present from 75-87 m. Massive stromatopoid limestones are present from 90 to 95 m. The stromatoporoid beds are overlain by dark-brown to black shales, with thin limestone interbeds which contain conodonts of Late Devonian (upper half of Frasnian) age (A. Harris, written commun., 1977). The thickness of the lmiestone varies through its area of exposure due to original depositional facies. It may represent a series of small patch reefs and interreef beds. Variation in thickness may also be due in part to tectonic factors. Limestone contains abundant coral and shelly faunas of late Middle and early Late Devonian age (J. T. Dutro, Jr., and W. A. Oliver, Jr., written commun., 1974, 1975, 1976). This unit locally includes discontinuous gray limestone beds of late Early or Middle Devonian age (No. 17, table 1). with both augite and pigeonite) set in a matrix of finer grained clinopyroxene and lath-shaped plagioclase. Secondary minerals include sericite, calcite, serpentine(?), chlorite and clinozoisite. Chemical analyses of two seperate pillow basalts indicate that the rocks are quartz-hypersthene and olivine-hypersthene normative tholeiitic basalt. Volcanic rocks commonly contain interbeds of black phyllite, chert-pebble conglomerate, light-green tuff and graywacke. The presence of massive basalt flows, breccia and agglomerate suggests in part subaerial and/or shallow-water ponded deposition. The unit is probably largely equivalent to, but is tentatively distinguished from unit Ebs by presence of massive basalt flows. LIMESTONE. -- Light-gray to light-brown, massive-weathering, marbleized limestone and local areas of thin-bedded to laminated limestone. Freshly broken surfaces of bedded limestone are dark gray and emit a fetid odor. Marbleized limestone contains probably Silurian dasycladacean algae and corals (J. T. Dutro, Jr., and W. A. Oliver, Jr., written commun., 1977). Bedded limestone contains rare graptolites of Silurian age (C. Carter, written commun., 1977). This unit is mapped only as small allochthonous blocks of arbleized limestone in unit Exus along north side of Shellabarger Pass (T. 28 N., h. 18 W.) and as a larger area of limestone on south side of pass. It may, in part, be equivalent to Silurian and (or) Devonian limestone in the Terra Cotta Mountains (Churkin and others, 1977). CHERT AND SHALE.-- Chaotically folded allochthonous sequence of interbedded graptolitic shale and chert, and minor sandstone and siltstone. Its thickness is unknown; some folds suggest penecontemporaneous deformation. Chert beds average about 7 cm thick and are rhythmically interbedded with black shale. Shale locally contains abundant Early to Middle Ordovician graptolites (C. Carter, written commun., 1977). The distribution of Ordovician rocks on the northern flank of Cathedral Spires (Tmc, T. 27 and 28 N., R. 19 W.) and the nature of their contact with adjacent sedimentary rocks (KJs and Ezus) is poorly understood because thermal metamorphism of Ordovician shale and siltstone (chert was not noted in this area) and KJs shale and siltstone has produced essentially identical-appearing metamorphic rocks consisting of dark-gray phyllitic shale and argillite. The presence of Ordovician rocks is indicated only by rare, poorly preserved graptolites in T. 28 N., R. 19 W. In addition, it locally contains discontinuous units of recrystallized limestone 5-30 m thick which may be tectonically emplaced slivers of unit Sl. The unit is tentatively correlated with Ordovician hemipelagic graptolitic shale and ribbon chert in the Terra Cotta Mountains (Churkin and others, 1977). SEDIMENTARY ROCKS OF DILLINGER RIVER. -- A thick sequence of sedimentary rocks presently recognized to consist of an undetermined thickness of interbedded lime mudstone and shales, more than 900 m of apparently unfossiliferous deep-water, well-bedded lime mudstone (micrites), and at least 900 m of interbedded sandstone, shale and limestone (Armstrong and others, 1977). Due to complex structural features and sparse megafossils, the relative age of these units is poorly known. Lime-mudstone and shale in the McGrath quadrangle (NW& Sec. 14, T. 27 N., R. 21 W.) contain poorly preserved Cardiolacea of upper Wenlockian (Silurian) age (J. Kriz, written commun., 1977). Limestone is medium-to dark-gray, weathers light-gray, is uniformly bedded, and locally contains conodonts of Silurian age (A. Harris, written commun., 1977). Beds range in thickness form 0.1 to 1.2 m, average about 0.2 m, locally contain well-formed pyrite cubes that are partially mantled by pressure fringes of quartz and light-gray chlorite. Shale beds are locally phyllitic and average 0.15 min thickness. A well-exposed sequence of interbedded sandstone, shale and limestone on the east side of Jones River in the McGrath quadrangle (T. 27 N., R. 22 W.) consists of an upper 360 m thick, massive, turbidite subgraywacke sequence underlain by 250 m of well-bedded argillaceous and dolomitic lime mudstone (micrite) containing Middle Silurian graptolites (C. Carter, written commun., 1977), and a lower 300-m-thick, massive-bedded subgraywacke to protoquartzite that contains interbeds of dark-gray silty shale. The lower clastic unit, which shows rhythmic and graded bedding and contains numerous shale fragments, is interpreted as a turbidite. East-trending isoclinal folds in the McGrath quadrangle, disharmonic folds on all scales north of the Tatina River, and multiple folds are also present. Intruded by dark-green, partially altered mafic dikes. These rocks can be traced westward into the McGrath quadrangle for at least 50 km and may, in part, be equivalent to t INTRUSIVE AND ULTRAMAFIC ROCKS FORAKER PLUTON.-- Medium-grained, equigranular biotite and hornblende granodiorite with a color index that averages about 13 but ranges from 9 to 20. Petrographic descriptions and modal and chemical analysis are given in Reed and Lanphere (1974). This pluton has nearly identical mineralogy and chemistry to the McGonagall pluton in the Mount McKinley quadrangle and both plutons are considered to be parts of a single igneous mass that has undergone right-lateral displacement of about 38 km along the McKinley segment of the Denali fault system since the igneous mass crystallized about 38 m.y. ago. Molybdenite-bearing quartz veins are associated with the Foraker pluton, and sparse cobbles of granodiorite on the Yentna and Lacuna Glaciers contain fractures filled with molybdenite, pyrite, and chalcopyrite.

A group of widely scattered, relatively large plutonic bodies generally restricted to unit KJs terrane south of the Denali fault. The Tonzona pluton, north of the fault, is also part of this sequence. The McKinley sequence is assigned to the Late Cretaceous and early Tertiary plutonic event in south central Alaska. Nine K-Ar ages on biotite and muscovite from the McKinley sequence range between 52.3 and 56.2 m.y. Although previously classified as quartz monzonite and granite (Reed and Lanphere, 1973a), the classification system used herein is that recommended by the IUGS (Streckeisen, 1973), and the rocks fall within the granite and granodiorite fields (fig. 1). In general, the rocks are coarse-grained, fresh, with equigranular to porphyritic hypidiomorphic textures. Biotite, generally in amounts between 3 and 10 volume percent, is the chief mafic mineral with hornblende being extremely rare or absent in most plutons. Muscovite is present in some plutons but generally makes up less than two volume percent of the rock. The plutons are epizonal and discordant, and generally lack xenoliths although they locally contain foundered blocks of country rock along their margins and apical parts.

RUTH PLUTON. -- A large granitic mass probably continuous at depth, which is described below as a north body, a south body, and the Chulitna body. The Chulitna body (T. 30 N. R. 5 W.) is medium- to coarse-grained, weakly foliated, hypidiomorphic-granular biotite granite. Rare hornblende is present in one sample. Apatite, allanite and zircon are characteristic accessory minerals, and tourmaline, fluorite and an unidentified zeolite are present in some samples. The south body (T. 31 N., R. 6 W.) is characterized by coarse-grained hypidiomorphic-granular biotite granite and granodiorite which locally is intensely weathered to grus. Rare muscovite or hornblende is present in some samples. The average color index of 10 samples is 10. Accessory minerals are the same as in the Chulitna body. The north body (T. 33 N., R. 6 W.) is medium- to coarse-grained hypidiomorphic-granular biotite and biotite muscovite granite. Average color index of seven samples is 6. The coarser grained granite typically weathers to grus. Tin anomalies from pan concentrate samples are spatially associated with iron stained, altered, and intensely weathered zones in the granite. Tourmaline, fluorite and topaz have been observed from some samples in addition to the characteristic apatite and zircon. COMPOSITE PLUTONS.-- A series of nine relatively small plutonic bodies, previously assigned to the Yentna series (Reed and Lanphere, 1973a), that form a 65-km-long curvilinear belt extending northeast form the granodiorite of Mt. Estelle to the headwaters of Cascade Creek (T. 28 N., R. 15 W.). The average composition of the plutons is quartz monzonite (fig. 1), but the larger and better exposed plutons are composite in nature and consist of distinctly different compositions that range from peridotite to granite. Where intrusive sequences have been established, the more mafic phases were the first to be emplaced. Some ultramafic bodies are distinctive in that they contain a significant amount of K-feldspar along with olivine, clinopyroxene and biotite. Olivine is commonly rimmed by pyroxene and biotite and, in the peridotites, is altered to fibrous amphibole and iron oxide minerals. Serpentine minerals were not noted. Mafic minerals in the more felsic rocks are biotite, rare to abundant patite is a characteristic accessory mineral. Prarmagin stock (T. 24 N., R. 20 W.)-- Medium-grained hypidiomorphic granular, Notite grante.

Kohlsaat pluton (T. 25 N., R. 20 W.)-- Composite pluton consisting of medium- to coarse-grained hypidiomorphic-granular biotite granite, hornblende-biotite granite and pyroxene biotite monzonite. K-Ar age date of 65.6+1.9 m.y. (Reed and Lanphere, Threemile stock (T. 25 N., R. 19 W.) -- Fine- to medium-grained, locally porphyriti pyroxene-bearing biotite quartz monzonite that contains altered phenocrysts of pyroxene. Kichatna stock (T. 26 N., R. 18 W.) -- Composite stock consisting chiefly of medium-to coarse-grained, hypidiomrophic-granular olivine-bearing pyroxene quartz monzonite; locally contains disseminated pyrite, pyrrhotite and chalcopyrite. Fourth of July stock (T. 26 N., R. 17 W.) -- Small pipe-like body of porphyritic peridotite containing euhedral phenocrysts of green clinopyroxene up to 5 cm long in a groundmass of clinopyroxene, bladed biotite, rounded olivine and interstitial potassium folderer potassium feldspar. Lower Yentna pluton (T. 28 N., R. 17 W.)-- Elongate composite body of medium- t medium-grained equigranular biotite peridotite, medium- to coarse-grained pyroxene quartz monzodiorite, porphyritic biotite-hornblende quartz monzonite, and biotite-pyroxene quartz syenite that contains blue chatoyant potassium feldspar phenocrysts up to 2.5 cm in length.

Cascade pluton (T. 28 N., R. 16 W.) -- Composite pluton consisting of potassium feldspar-bearing peridotite, medium-grained hornblende quartz monzodiorite and biotite granodiorite, and a late phase of medium- to coarse-grained porphyritic pyroxene-biotite quartz monzonite. Copper and gold mineralization indicated by stream sediment and pan concentrate samples from Cascade Creek. K-Ar age date of 64.6+1.8 m.y. (Reed and Lanphere. 1973a). and pan concentrate samples from Cascade Creek. K-Ar age date of 04.0±1.0 m.y. (Reed and Lanphere, 1973a).

East Fork Yentna stock (T. 28 N., R. 15 W.)-- Medium-grained, hypidiomorphic-granular, pyroxene-bearing, biotite granodiorite.

Shellabarger stock (T. 28 N., R. 18 W.)-- Small poorly exposed stock of altered biotite-pyroxene gabbro which lies northwest of the main composite plutonic belt. Relation to the composite plutons unknown. Locally contains abundant disseminations of specular hematite. Semiquantitative spectrographic analyses of three grab samples average 1000 ppm copper. KICHATNA PLUTONS. -- Nine small plutons, some of which were previously assigned to the Yentna series (Reed and Lanphere, 1973a), located southeast of the belt of composite plutons (TKc). The average composition of these rocks is granodiorite, but quartz monzodiorite and quartz diorite are also present (fig. 1). The rocks are predominantly medium grained and hypidiomorphic-granular; dark reddish-brown biotite and light-green hornblende comprise about 22 volume percent of the rocks. Biotite generally exceeds hornblende. Allanite, apatite and zircon are characteristic accessory minerals. A K-Ar age date of 67.4+2 m.y. (Reed and Lanphere, 1973a) from a hornblende biotite quartz diorite (T. 23 N., R. 17 W.) suggests that these rocks may be slightly older than the composite plutons. UNDIVIDED INTRUSIVE ROCKS.-- Small intrusive bodies of Late Cretaceous or Tertiary age WINDIVIDED INTRUSIVE ROCKS. -- Small intrusive bodies of Late Cretaceous or Tertiary age with compositions that preclude definite assignment to the above intrusive sequences. Owing to difficult accessibility many of these bodies could not be sampled and their contacts were mapped from the air. The petrography and composition of these rocks are incompletely known. The rocks sampled range in composition from granite to tonalite. The small body located along the Susitna River (T. 29 N., R. 4 W.) is a weakly foliated, fine- to medium-grained, hypidiomorphic-granular biotite granodiorite. The two small intrusive bodies of biotite granite and biotite hornblende granodiorite (T. 32 N., R. 5 W., and T. 33 N., R. 4 W., respectively) may be satellitic bodies of the Ruth pluton. At Little Peters Hills (T. 26 N., R. 8 W.) a small body of equigranular medium-grained biotite granite. thought to belong to the McKinley sequence. MzPzi
UNDIVIDED INTRUSIVE ROCKS.-- Dark-gray to greenish-gray dikes and sills that range in composition from basalt to gramodiorite. Most bodies are porphyritic and contain altered phenocrysts of plagioclase and amphibole in a matrix of fine-grained feldspar, quartz and alteration minerals. Clinopyroxene is rare. The age is unknown. Most bodies are too small to show at scale of map. granodiorite and Mount Foraker (Tf). Olivine is recrystallized and (or) altered to serpentine minerals, talc and amphibole; shearing and deformation banding are common. Chromite occurs chiefly in dunite sills as (1) disseminated rounded grains 1-3 mm in diameter, (2) streaks and lenses, (3) disrupted and irregular pods of various shapes up to 2 m in maximum dimension that are cut by dunite and (4) lens-like bodies up to 2 m thick and 20 m in length. Chrome content of typical dunite ranges between 0.7 and 1 percent. The average of 3 microprobe analyses from one sample of chromite (T. Thayer, written commun., 1976) is 58.4 percent Cr<sub>2</sub>O<sub>3</sub>, 21.1 percent FeO, 8.9 percent MgO, and 9.7 percent Al<sub>2</sub>O<sub>3</sub>. Serpentinite, composed of dark-green serpentine minerals and magnetite, locally contains relict oliving crystals altered to antigorite and crysotile. It is cut by veins of fine-grained carbonate and unidentified clay minerals. Emerald-green chrome-nickel garnets, locally present in calc-silicate rocks (D1?) adjacent to dunite, suggest that the dunite was emplaced at moderately high temperatures. SEDIMENTARY AND VOLCANIC ROCKS SEDIMENTARY AND VOLCANIC ROCKS.-- Massive cliff-forming outcrops of silicified argillite, radiolarian chert, siltstone, minor pillow basalt and impure micritic limestone. Yellowish gray to black silicified argillite and chert is well bedded, and individual beds average about 8 cm in thickness. Siltstone is dark gray, rust weathering, and well sorted and contains abundant angular quartz, feldspar and metachert fragments that average 0.2 mm in size. Minor pillow basalt in units up to 3 m thick is composed of medium-grained plagioclase and clinopyroxene. Clinopyroxene is altered to bluegreen amphibole and chlorite. matrix. These rocks commonly contain interbeds or massive micritic and blociastic limestone, minor chert, argillite, rust-weathering siltstone and sandstone, and basaltic tuff. The coarser grained tuffaceous volcaniclastic beds average about 0.6 m in thickness and contain angular to subrounded clasts of quartz, chert, volcanic rocks and siltstone up to 7 cm in maximum dimension. In places the texture appears cataclastic and in others the rock is a sedimentary breccia. Unit contains locally abundant fossils including Thecosmilia, Heterastridium and Septocardia(?) of Upper Triassic (Norian) age (N. Silberling, written commum., 1977). Basaltic tuff consists of plagionals or overtals and volcanic rock fragments in a semischierose matrix of ablarity and LIMESTONE AND BASALT.-- Upper Triassic limestone and basalt form a distinctive unit northeast of the Eldridge Glacier (Clark and others, 1972) and apparently are gradational southwest into interbedded gray limestone, dark-green pillow basalt, massive and locally semischistose basaltic tuff, calcareous sandstone, and minor black chert and silty limestone. The limestone is discontinuously exposed, usually interbedded with or included within, basalt. It is commonly massive and marbleized but locally is well bedded and contains volcanic rock fragments. Dark-green basaltic rocks form massive-weathering outcrops. Recognizable pillow basalt is subordinate to basaltic tuff, but pillows up to 45 cm in diameter are locally present. Irregular masses of chlorite, epidote, fibrous amphibole and iron oxides suggest the former presence of mafic minerals. The pillow basalt contains interbeds of black chert and phyllite. Basaltic aquagene(?) tuff is dark green, massive, locally semischistose, and consists of lapilli-sized fragments of various types of volcanic rocks. Also present are coarse lenses of chlorite and calcite with unidentified birefringent microlites, and sparce plagioclase. Schistose basaltic tuffs contain lenses of clinopyroxene phenocrysts and amygdules of calcite, quartz and epidote, and chlorite and quartz. Locally abundant fossils from this unit include Monotis subcirularis Gabb, Heterastridium, and Cassianella of Late Triassic (Norian) age (N. Silberling, written commun., 1977). REFERENCES CITED Armstrong, A. K., Reed, B. L., and Carter, C., 1977, Paleozoic sediments in the north-west part of the Talkeetna quadrangle, Alaska Range, Alaska: U.S. Geol. Survey Circ. 751B, p. B61. Bundtzen, T. K., Smith, T. E., and Tosdal, R. 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biotite muscovite granite form the rugged and spectacular Cathedral Spires (T. 27 N., R. 19 W.). The rocks also contain minor phases of biotite-hornblende granodiorite. A small, petrographically similar body of fine-grained biotite granite occurs in T. 26 N., R. 17 W. Average color index of six samples is 8; apatite and zircon are characteristic accessory minerals but fluorite, tourmaline, and allanite are also present.

KAHILTNA PLUTON. -- A relative large mass of granite and granodiorite which is geographically separated into two bodies by the Kahiltna Glacier. The body to the southwest is fine- to coarse-grained, hypidiomorphic-granular biotite and biotite muscovite granite and granodiorite. The average color index of nine samples is 12. Apatite and zircon are characteristic accessory minerals, but tourmaline, garnet and allanite are locally present. Samples from the northeast body are medium- to coarse-grained, hypidiomorphic-granular biotite muscovite granite. Minor tin anomalies are associated with quartz tourmaline muscovite greissen zone at the head of Hidden Creek (T. 30 N., R. 10 W.). The average color index of 10 samples is 8. A small satellitic body of fine- to coarse-grained biotite hornblende granodiorite (T. 31 N., R. 9 W.) is included with the Kahiltna pluton.

Table 1.-- Location and age of selected fossil collections in the Talkeetna quadrangle, Alaska. 6 76AR132 Pzus T29N J.T. Dutro, Jr. R15W 13 74AR135 76ANs16 76ANs17 76ANs18 Pelecypods pelecypods (late Norian) 36 76ANs59B Pelecypods Late Triassic Rvs T22S N.J. Silberling R13W

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