THE BASEMENT COMPLEX Purpose Nature of Complex Péwé, T.L., (1958), Geology of The Fairbanks D-2 Quadrangle, Alaska, U.S. Geol. Survey Map GQ110. his map and the remarks to follow compose a progress report on Metamorphic Grade of the Crystalline Schists The crystalline schists of the Birch Creek sequence compose A third belt of calcareous-magnesian rocks, including impure the structural framework of the basement complex in the Fairbanks
District. Many different metamorphic rock types are included in the marbles, was recognized during our work in summer 1961. This belt has a northwest trend, and can be traced from southeast to northwest The assignment of metamorphic grade to Birch Creek rock units is complicated by their polymetamorphic history. Many units show evidence of more than one cycle of deformation and recrystallization. Until as supported by the State of Alaska Division of Mines and , and Rivard, Norman R., (1961), Geologic map and section of the Fairbanks D-3 Quadranqle, Alaska, U.S. sequence, but micaceous quartzites and quartz-mica schists are by outcrops on Lackloey, Approach and College Hills, and to the bluffs overlooking the Tanana, near the old Chena Townsite. Rock types included in this belt include phlogopitic marble chlorite bearing marbles, enidote activality white olumetrically dominant; a relationship also noted by Brooks at the detailed petrographic studies and isotope age determinations are This preliminary map is designed to make interim information Geol. Survey Map I-340. lable to the public, prior to the release and publication of the "Type Locality", in the Circle District. completed, the location of isograds, metamorphic zones, and the related age of units in the sequence must remain in doubt. From the work done so far, however, the highest grade crystalline schists (medium grade) occur in a zone which approximately parallels the Goldstream Valley from Fox northeast to the head of Tom Creek. Prindle, L.M., Katz, F.V., and Smith, P.S., (1913), A geologic bearing marbles, epidote-actinolite-albite schists and carbonate Birch Creek metamorphics and/or granitic intrusives are reconnaissance of the Fairbanks Quadrange, Alaska, U.S. Geol. Survey Bull. 525. believed to underlie the surficial deposits in all parts of the District. A few isolated masses of olivine basalt occur which are believed to be of Tertiary age. These basalts were apparently Background The table below lists the metamorphic rock types collected from the Birch Creek sequence during the 1961 field season. Following Felix Pedro's 1902 discovery of placer gold in the Units cropping out in this zone include amphibolites, tremolite Williams, J.R., Péwé, T.L., and Paige, (1959), Geologic map of epidote marbles and garnet-mica gneisses. The precise boundaries of this zone are not known, but the metamorphic grade of rocks several airbanks District, and the rapid development of the area as a placer ining camp, the inevitable search for bedrock sources of the placer basement complex.

Std begrap The first quarks also be development of the area as a placer basement complex. the Fairbanks D-1 Quadrangle, U.S. Geol. Survey Map GQ-110. Pelitic Schists and Quartzites: miles northwest or southeast gradually decreases to upper low grade (phyllites and phyllitic schists). micaceous quartzites Birch Creek Schist (bcs) Dome and Ester Dome lode mining areas were well defined by 1915. quartz-mica schists Exploitation of scheelite deposits began in 1915, and exploration and actual production accompanying the favorable price of tungsten during both Norld Wars delineated zones of tungsten mineralization in the Pedro and Gilmore Dome areas.

The Birch Creek sequence is chiefly composed of metasediments. Only a few rocks have mineral compositions which suggest an igneous ancestry; and in outcrop, these units seem to be at least paraconformable with adjacent rocks of known sedimentary parentage. The chemical composition, stratigraphic succession and delicate intercalation of Birch Creek sequence is chiefly composed of metasediments. The Birch Creek sequence is chiefly composed of metasediments. mica schists Structure mica schists muscovite and/or biotite; garnet-mica schists w/rare staurolite or andalusite The Birch Creek sequence has been severely deformed, and recrystallized; and it has been submitted to at least two major deformational cycles. The first cycle that can be detected in the deformational cycles. The first cycle that can be detected in the fabric of these rocks was accompanied by complete recrystallization, and a metamorphic grade which was higher than that associated with the later cycle. Preliminary analyses seem to indicate that the earliest folds had a westerly or northwesterly trend, and the later garnet-mica gneisses sequence was principally derived from the dynamic metamorphism epidote bearing biotite gneisses break of World War II; and a small amount of scheelite was mined and of a rather thick sequence of sediments.

Shipped from the Gilmore Dome deposits during both World Wars. Since Amphibolites\_and\_Lime\_Silicate\_Rocks: 1946, however, lode mining and exploration has been sharply curtailed, and at the time of this report, the Vetter-Sheldon open cut mine on structural trends were northeasterly. Folds associated with the first deformation were apparently isoclinal to sub-isoclinal and Quartzites containing various amounts of muscovite (sericite), biotite, plagioclase feldspar (albite or oligoclase) and graphite are volumetrically the most common rock types recognized in the section. tremolite-carbonate-quartz schists the ridge between Wolf and Chatham Creeks was the only known overturned or recumbent. In some areas compositional layers parallel the foliation, and both display gentle or even horizontal attitudes; and these attitudes are misleading, as they represent chlorite-carbonate-quartz schists clinozoisite-carbonate-quartz schists These impure quartzites grade into quartz mica schists, when either or both of the micas become major constituents. Mica schists, often garnet bearing, also occur in the sequence; derived from parent rocks of more argillaceous composition. Schists containing alumina excess minerals such as staurolite and andalusite are very rare; which may be due to complexities in the metamorphic history rather. productive lode gold property in the District. linozoisite-actinolite-phlogopite-oligoclase schists Factors Influencing the Localization the limbs of recumbent or overturned folds - not flat lying or gently dipping beds. \_\_\_ and Occurrence of Ore Bodies oligoclase-epidote amphibolites garnet-biotite amphibolites Previous work by Brooks (1916), Prindle, Katz and Smith (1913), Hill (1933), Mertie (1937), Byers (1957), Péwé (1958), and Williams, Péwé and Paige (1959) has supplied considerable information on the which may be due to complexities in the metamorphic history rather than chemical restrictions. Intercalated quartzites and mica schists are found throughout the whole District, and although quartzose units Earlier fold axes are often paralleled by a "b" lineation Earlier fold axes are often paralleled by a "b" lineation defined by biotite, amphibole or muscovite, and less commonly sericite. Muscovite or sericite which has recrystallized at the time of the second deformation may also define a "b" lineation locally which transects the earlier "b", and parallels the axes of the younger northeast trending folds. In some outcrops, the earlier schistosity (S,) is transected by a later schistosity defined by retrograde, sericite or muscovite (S.) occur more frequently than the mica schists, no well defined zone is known where either type excludes the other. chlorite bearing tremolite marbles geology and ore deposits of the Fairbanks District. clinozoisite marbles phlogopite marbles Brooks, Prindle, Smith, Hill, Mcrtie and Byers have previously studied factors which appear to influence the localization and rientation of lode deposits. From their work, it is known that Discontinuous masses of gneissic rocks occur in the northeastern part of the map area, which appear to have elliptical outcrop patterns paralleling the northeast strike of the adjacent schists. retrograde sericite or muscovite (S2). t e gold bearing quartz veins are localized on the southeast flank of Ester Dome, along the crest of an anticline; and that the mi. eralized veins in the Pedro Dome-Cleary area trend northwest, also These gneisses generally have a granodioritic composition, and their Contact (static) Metamorphism Although the northwest trending folds appear to be always over-turned and/or recumbent, with axial planes usually dipping to the south, the degree and direction of overturning is variable, and related to the culminations and depressions of the superimposed northfabric is typically porphyroblastic; including small blebs of crystalloblastic K and plagioclase feldspar. These gneisses may be paralleling the crest of a broad anticline. In both areas, the mireralized veins appear to be genetically related to the emplacement Zones of contact metamorphism adjacent to intrusive contacts are well developed at two localities in the District; and there is evidence to suggest that contact metamorphic effects are present over much greater areas than those immediately adjacent to known intrusive bodies. The high temperature lime silicate mineral assemblages derived from either acid igneous or sedimentary rocks with or with-out the metasomatic addition of Na and/or K. Contact relationships of granitic intrusives; porphyritic quartz monzonite in the Pedro name - Cleary Summit area, and small quartz dioritic and/or east trending structures. with adjacent units which would aid in solving this problem are granodioritic masses in the Ester Dome area. Some of the parent quartzose sandstones in the sequence contained careous and/or dolomitic components along with - or rather than Investigation Objectives calcareous and/or dolomitic components along with - or rather than argillaceous impurities. During recrystallization these rocks developed epidote, clinozoisite, actinolite, hornblende, chlorite and carbonate, as governed by available Ca, Mg, Fe and Al in addition

These units are more often associated with a redirect contained related to recrystallization caused by thermal effects which accompanied the emplacement of the porphyritic granite which under-lies the ridge.

Our studies on the granodiorite body which cuts the schists The Birch Creek sequence has been provisionally dated as Precambrian by earlier workers. There is some doubt as to whether any or all rock units assigned to the Birch Creek sequence are in The Birch Creek schist is the country rock for most of the odes in the Fairbanks District; and although it has become acreasingly obvious that mineralization is oftimes controlled by fact of Precambrian age. Specimens from critical localities have been submitted for isotope dating, and objective information concerning the absolute age of the Birch Creek units in the Fairbanks District should be available for presentation in the final report in and carbonate, as governed by available Ca, Mg, Fe and Al in addition to SiO<sub>2</sub>. These units are more often associated with or adjacent to calcareous schists, amphibolites and marbles.

Our studies on the granodiorite body which cuts the schists exposed at Approach Hill, Fort Wainwright, and the contact zone, show that high temperature lime silicate assemblages have recrystallized in the calc-schists, and that Mg contamination from the country rock tructure or compositional affinity of a rock unit, little detailed information of this kind has been available. Our investigations were designed to provide more detailed information on the structure and petrology of the rock units composing the Birch Creek schist in the Fairbanks Mining District; with the aim of applying such Two belts of calcium-magnesium rich rocks, including lime silicate rocks, amphibolites and impure marbles were recognized and delivered by earlier workers in the District. The first of these belts transects the valleys of Dome and Little Eldorado Creeks on the northwest flank of Pedro Dome. The compositional layers and schistosity planes of these rocks strike northeast, paralleling the outcrop pattern of the belt and the attitude of fold axes. An earlier view held that this belt represents a considerable stratigraphic thickness of Ca-Mg rich units; but the structures mapped during this study suggest that these units are tectonically has created a marginal hypersthene bearing facies in the grano-diorite body near the contact which is similar in composition to an knowledge to systematic prospecting and evaluation of mineral Opdalite, as defined by Goldschmidt. BIBLIOGRAPHY High temperature lime silicate minerals (wollastonite, vesuviannite, diopside, grossularite) appear to define a crystallization foliation in the schists. When serial samples are studied away from the contact, however, the high temperature assemblage is gradually replaced by lime silicate assemblages of the medium grade zone, and the same units which crop out on Lackloey Hill to the east show only low grade metamorphic minerals. The Information Contained In This Report Byers, F.M., Jr., (1957), Tungsten deposits of the Fairbanks District, U.S. Geol. Survey Bull. 1024-I e structure, contacts and vein locations here displayed should not considered final. This map does not differentiate the various rch Creek schist rock types as separate map units. Until laboraduring this study suggest that these units are tectonically Brooks, A.H., (1916), Antimony deposits of Alaska: U.S. Geol. Survey Bull. 649, pp. 20-23. repeated by a series of folds. cory work is completed, the terrane underlain by Birch Creek schist will be shown on these maps by the symbol (bcs) In this report no attempt is made to present the detailed petrology of the intrusive and extrusive rocks which crop out in the District; as this information will be included in the final report. The main objective The second belt, also recognized for a good many years, Hill, James H., (1933), Lode deposits of the Fairbanks District, parallels the crest of the ridge extending southeast from Gilmore Dome. This belt crosses the Goldstream Valley above Fox however, Clearly, the high temperature lime silicates at Approach Hill are Alaska, U.S. Geol. Survey Bull. 849-B. directly related to the emplacement of the intrusive. Whether or not the schistose fabric which is apparently defined by the lime silicate and cannot be followed with certainty beyond that locality. The Mertie, J.B., Jr., (1937), The Yukon-Tanana Region, Alaska, belt includes amphibolites, epidote bearing schists and gneisses and several types of marble.

minerals is real or mimetic, remains to be determined. If real, the pluton was synkinematically emplaced. U.S. Geol. Survey Bull. 872. PRELIMINARY MAP OF THE BEDROCK GEOLOGY OF THE FAIRBANKS MINING DISTRICT, ROCK UNITS ALASKA Tb Olivine basalt Robert B. Forbes and Jim M. Brown Department of Geology gd Pyroxene bearing granodiorite College of Earth Sciences and Mineral Industry University of Alaska gr-qm Porphyritic granite or quartz monzonite for the MAP SYMBOLS DIVISION OF MINES AND MINERALS DEPARTMENT OF NATURAL RESOURCES Strike and plunge of fold axes STATE OF ALASKA Quartz monzonite ≥10 Strike and plunge of b lineation based on Strike and plunge of striations Field and laboratory work by Forbes and Brown, 1961, MAP SYMBOLS Biotite-hornblende quartz diorite or crinkles and information taken from Synclinal axis U.S. Geological Survey Geological Maps of the Fairbanks bcs Birch Greek Schist (undifferentiated) o Fault D-1, D-2 and D-3 Quadrangles: (Troy L. Péwé) (J.R. Williams Anticlinal axis and Troy L. Péwé) (Troy L. Péwé and Norman R. Rivard). Overturned anticline U.S.G.S. Bulletin #1024-1, (F.M. Byers Jr.) Strike and dip of foliation (attitude of axial plane) U.S.G.S. Bulletin #872; (J.B. Mertie Jr.) Mineralized veins U.S.G.S. Bulletin #849; (J.M. Hill) Horizontal foliation Intrusive Contact (inferred) U.S.G.S. Bulletin #525; (L.M. Prindle, F.J. Katz, Philip S. Smith) PECEMBER 1961