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GEOLOGIC MAP OF THE IDITAROD C-3 QUADRANGLE, ALASKA

By

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INTRODUCTION AND ACKNOWLEDGMENTS

The Iditarod C-3 Quadrangle lies on the eastern edge of the Kuskokwim Mountains, a maturely dissected upland of accordant, rounded ridges and broad, sediment-filled lowlands. Elevations range from 800 ft near the Moore Creek gold mine to 3,009 ft on VABM Willow. The results presented here are a continuation of mapping completed to the northeast by Bundtzen and Laird (1982, 1983a, 1983b). This map is prepared in cooperation with the U.S. Geological Survey, who are conducting studies in the Iditarod Quadrangle under the Alaska Mineral Resource Assessment Program.

We thank Don Harris of McGrath for discussions of the Moore Creek gold placers, the Broken Shovel silver-gold deposit, and the general mining history of the map area. Joel Blum (DGGS) provided K-Ar radiometric ages for the study (table 1). M.K. Polly, M.R. Ashwell, T.A. Benjamin, and N.C. Veach of the Division of Geological and Geophysical Surveys (DGGS) Minerals Laboratory provided timely geochemical and major-oxide analyses of rock samples from the study area. J.T. Kline spent several days with the field party during 1983 investigations. Jim Barker of the U.S. Bureau of Mines provided benefication studies of chrome placers. We appreciate the thoughtful reviews of J.T. Kline (DGGS) and M.L. Miller (U.S. Geological Survey).

BEDROCK GEOLOGY

The oldest unit in the map area, a thin structural sliver of radiolarian chert and tuffaceous sandstone (PzJc) near Deadwood Creek, correlates with Paleozoic through Jurassic Innoko Terrane lithologies to the northeast (Bundtzen and Laird, 1983a; Chapman and others, 1982). The major stratigraphic units in the map area are poorly exposed sandstone, shale, and siltstone of the Kuskokwim Group (Cady and others, 1955), which ranges in age from late Early to Late Cretaceous. In the study area two different sections of the Kuskokwim Group are juxtaposed along the Nixon-Iditarod fault, which bisects the area into two regions. Layered rock units southeast of the fault comprize a folded section of undifferentiated turbidites, shallow marine, and nonmarine clastic deposits at least 3,500 m thick that are not subdivided because of general lack of adequate bedrock control. The 2,700 m thick, Kuskokwim Group section northeast of the Nixon-Iditarod fault can be subdivided into mappable units and is very similar to the stratigraphic section described by Bundtzen and Laird (1983a) 60 km to the northeast (fig. 1). Units interfinger laterally and vertically. The oldest recognized Cretaceous unit consists of shale, siltstone, and fine-grained lithic sandstone deposited in a distal to midfan turbidite environment. Distinctive calcareous turbidites rich in *Inoceramus* shell fragments and plant fragments (Ktls, Ks units) overlie fine grained clastics (Ksh). Increasing amounts of flora rich, medium to coarse grained pebble bearing lithic and sublithic sandstone (Kcs), and volcaniclastic sandstone (Ksv), appear progressively higher in the section. The presence of A-E BOUMA intervals (Mutti and Ricci Lucchi, [illegible] sand-shale ratios exceeding [illegible], channeled sandstone bodies, and numerous flute casts suggest a coarse (perhaps inner) turbidite fan depositional facies. Near the top of the section, relatively clean quartzose sandstone, plant rich shale, and absence of turbidity current indicators of the Kfss unit are features interpreted as forming in a marginal to shallow marine (or nonmarine) environment, probably a shoreline facies. Similar units to the northeast and southwest contain leaf beds and coal seams (Mertie, 1936; Patton and others, 1976; Bundtzen and Gilbert, 1983).

Sparce paleocurrent data from high energy flow regime structures in turbidites (Ktls, Kss, Kcs) suggests southwesterly or westerly current directions; however, current directions from low energy flow regime indicators in the Kfss unit are dominantly northeasterly (table 5).

Overlying the Cretaceous clastic rocks are subaerial volcanic rocks that range from 300-500 m thick. The volcanic pile is part of a 400 km^2 volcanic field that is best exposed in the Beaver Mountains to the north (Bundtzen and Laird, 1982). Five mappable units range in composition from rhyolite to basalt, but porphyritic to nonporphyritic varieties or pyroxene andesite predominate. The basal unit composed of altered andesite-dacite (Kvt) contains interbedded sublithic sandstone and shale identical to lithologies in the underlying lithic to sublithic sandstone (Ks), which suggests conformity between the Kuskokwim Group and overlying volcanic rocks. The Kvt unit is successively overlain by intermediate volcanic rocks (Kvi), porphyritic andesite (Kvpi), volcanic agglomerate (Kva), and mafic volcanic rocks, mainly olivine-augite basalt (Kvm).

Four small 2-4 km^2 monzonite to quartz monzonite plutons intrude the volcanic rocks near Maybe, Willow, and Moore Creeks, and a fifth intrudes sedimentary rocks on the south flank of Camelback Mountain. Hornfels aureoles extend approximately ½ km from the contact zones of the plutons. The three northernmost plutons are crudely aligned in a 12 km long, north-trending zone that extends from the Nixon-Iditarod fault zone at Moore Creek to Moose Creek, suggesting emplacement control along a cross-fracture system.

Whole rock major-oxide chemical analyses and CIPW norms for igneous rocks in the map area (table 4) are similar to analyses previously published from rocks to the north (Moll and others, 1981; Bundtzen and Laird, 1982, 1983a, 1983b). Andesite, rhyolite, and quartz-monzonite show broad calc-alkaline trends, and the monzonitic stocks and plutons are subalkaline and undersaturated. Basalt and basaltic andesite have higher than average alkali content and usually contain both normative and modal olivine and occasionally normative nepheline. Corundum- normative dacite to alaskite domes or sills intrude the Nixon-Iditarod and Moore Creek fault zones both within and north of the map area. Bundtzen and Swanson (1984) suggest that, overall, the suite is alkali-calcic and occupies a transitional chemical suite between calc-alkaline and alkaline rocks.

Potassium-argon biotite, hornblende, plagioclase, and whole-rock ages range from 58-75 m.y. (table 1), typical of those reported from coeval volcanic and plutonic units in the Medfra area (Moll and others, 1981) and Innoko-Takotna areas (Bundtzen and Laird, 1982, 1983a).

QUATERNARY GEOLOGY

Quaternary deposits are subdivided on the basis of photogeology and ground reconnaissance. Most of the study area was not glaciated during Pleistocene time; however, the 2,700- to 3,000-ft-high upland areas at the headwaters of Maybe and Moore Creeks and at the head of Montana Creek on Camelback Mountain were probably occupied by at least three small valley glaciers. Modified cirque morphology suggests correlation with the early Wisconsinan Bifurcation Creek glaciation in the nearby Beaver Mountains (Bundtzen, 1981).

Tertiary-Quaternary uplift along the Nixon-Iditarod fault accelerated erosion of old pediment surfaces and terrace alluvium. On Fourth of July and Willow Creeks, extensive aprons of alluvium and colluvium were deposited where the streams emerge from upland source areas. Evolution of a fan-terrace complex (Qft) along the trace of the Nixon-Iditarod fault may have important significance for concentration of heavy-mineral placers near Moore Creek. Widespread deposits of organic silt are accumulating over lowland areas, and thermokarst processes are modifying these and various undifferentiated Quaternary deposits in the study area.

STRUCTURAL GEOLOGY

Volcanic and sedimentary rocks northwest of the Nixon-Iditarod fault have been folded into broad, open, northeast-trending synclines and anticlines with amplitudes of 2 to 3 km; plunge directions of these fold structures are unknown. Extensive Quaternary cover prevented detailed fold analysis southeast of the Nixon-Iditarod fault; however, airphoto trends and overturned bedding attitudes suggest significant compressional stress was directed at lithologies within the wedge shaped block between the Moore Creek and Nixon-Iditarod Faults. Columnar jointing in some outcrops of andesite (Kva) and basalt (Kvm) indicates that volcanic flows were deposited in a subaerial environment that post-dated marine deposition of Kuskokwim Group sedimentary rock units. The Nixon-Iditarod fault, a major strike-slip feature in western Alaska, juxtaposes volcanic rocks against Kuskokwim Group clastic units through much of the map area. Airphoto analysis indicates that a prominent escarpment cuts Quaternary fan-terrace and undifferentiated deposits from Moore Creek to Fourth of July Creek, which suggests Holocene activity. Airphoto analysis also indicates distinctive right lateral drag along the trace of the Moore Creek fault, and is evidenced by deformed bedding near Banner Creek on plate 1.

ECONOMIC GEOLOGY

The mineral deposits of economic significance include the gold-cinnabar-chromite placer deposits on Moore, Fourth of July, and Deadwood Creeks, the Broken Shovel silver-gold lode, and sand and gravel deposits in tailings at Moore Creek. Geochemical results of a reconnaissance chip-sampling program are reported in table 2; samples are from ferricrete gossan zones in volcanic and plutonic rocks, mineral prospects, and fault zones. We emphasize that most of the sampling was neither uniform nor representative; however, chip-channel samples collected at the Broken Shovel lode prospect are believed to be fairly representative of parts of the mineralized system. Gossan zones in altered andesite-dacite (Kvt) contain subtle mercury, silver, and lead anomalies. The pervasive alteration in this unit may be wholly stratigraphic in origin or may be thermal alteration related to the plutons on Maybe and Willow Creeks.

The Broken Shovel lode (no. 33, table 2, pl. 1) is a tetrahedrite-arsenopyrite ± scheelite quartz-tourmaline vein hosted in altered monzonite of the Moore Creek pluton. It was discovered and explored by Warner Stewart of Flat sometime prior to World War II. The deposit was crosscut by two large trenches in 1981. The zone is 1-4 m thick and can be traced along strike for at least 100 m, and is obscured by vegetation and colluvium on both ends. The vein dips steeply to the southeast and has sharp contacts with enclosing monzonite. The mineralized quartz and tourmaline gangue includes 5 to 10 percent total sulfides. Arsenopyrite is commonly altered to scorodite, and malachite stains are common around tetrahedrite grains. Fluid inclusion homogenization temperatures from quartz in the shear zone range from 254° to 380°C and average 297°C (N=14). The vein is similar in mineralogy, structural style, and metal content to the Cirque and Tolstoi deposits described by Bundtzen and Laird (1982) that occur 45 km north, and to the Golden Horn deposit at Flat 60 km to the southwest (Bundtzen and Gilbert, 1983). All of these deposits contain copper, silver, gold, tungsten, and minor bismuth or tin, and are localized within recently unroofed copulas of differentiated plutons or stocks intruding the Cretaceous clastic section (Bundtzen and Swanson, 1984).

A 300 m^2 area of distinctive green to light blue, chalcedony veins cut altered volcanic rocks (Kvt unit) near the head of Moose Creek (map nos. 2-4; table 2; pl. 1). The veins vary from 2-20 cm wide but could not be traced along strike because much of the material is contained in frost riven rubble. Samples of the blue chalcedony have been polished in tumblers resulting in handsome stones suitable for show or jewelry. Agate localities in volcanic agglomerate are also indicated on plate 1.

Anomalous copper, lead, zinc, and silver occur in fault breccias and contact zones of the Camelback Mountain pluton (nos. 38-40, table 2; pl. 1); however, no placer gold concentrations are known downstream from these mineralized areas.

Virtually all mineral production in the area has been derived from gold placers at Moore Creek. Nevada Gulch and Moore Creek were hand mined initially in 1913 and constitute the original discoveries in this subunit of the Iditarod mining district. During the 1920s, 1930s, and 1940s, Finnish immigrants, Utilla and Yuturi mined lower benches and modern stream alluvium on Moore Creek for a distance of nearly 2 km. During this time about 20,000 ounces of placer gold were recovered mainly from the period 1935-43. Joe and Jules Stuver mined bench gravels near the present camp during the 1950s and 1960s. Total gold production from Moore Creek is estimated at 54,000 ounces of gold and 12,500 ounces of silver based on examination of unpublished U.S. Mint returns through 1968, and discussions with Don Harris, current owner of the claims. Gold fineness averages 752 with silver and copper as the major impurities. Gold is generally coarse with nuggets of up to 22 ounces recovered in recent years. Principal heavy minerals include cinnabar, ilmenite, and chromite. The bedrock surface of the entire paystreak is Cretaceous clastic rocks. The Moore Creek placers occur in fan-terrace, alluvial terrace, and modern stream alluvium that vary from 1-5 m thick and average about 2 m thick. The rounded stream gravel clasts average 30 cm in diameter and consist of monzonite (10 percent), augite basalt (60 percent), silicified sandstone (20 percent), and minor shale (10 percent). Locally iron rich concretions up to 20 cm in diameter are common in shale-sandstone bedrock paystreaks (no. 34; table 2; pl. 1). The bedrock source of the Moore Creek placers is probably the deeply dissected monzonite plug that crops out on the hillside 2½ km northwest of Moore Creek placer camp. The monzonite plug hosts crosscutting mineralized sulfide-quartz veins including the Broken Shovel silver-gold lode previously described. Modern streams draining the monzonite were mined for placer gold during earlier years. There is a distinctive trend of younger auriferous gravel deposits downstream to the (east-northwest), with the older bench levels progressively elevated above the modern floodplain of Moore Creek in an upstream direction (west-southwest). The Nixon-Iditarod fault forms the southern structural boundary of the Moore Creek pluton, and has a right lateral slip component of up to 90 km since Cretaceous time (Grantz, 1966; Patton and others 1984). We speculate that the placer deposits have been offset by right lateral fault movement from their lode source through Tertiary-Quaternary time, with the oldest deposits to the southwest and progressively younger gravel to the northeast; older undiscovered bench placers originating from the monzonite may occur further to the southwest.

Placer gold was discovered and developed on Fourth of July Creek beginning in 1915 (D. Harris, personal commun., 1984). Recent exploration-development activity continues. No past production figures are available, but Robert and Manzie Magnuson of McGrath recovered modest amounts of placer gold during the 1982-83 field seasons. The Fourth of July Creek placer deposits appear to be entirely in Holocene alluvium, and the source of gold appears to be the southern contact zone of the Maybe Creek pluton. Heavy-mineral concentrates in Fourth of July Creek contain chromite, cinnabar, scheelite, and gold. Rounded clasts of basalt, hornfels, and monzonite up to 1 m in diameter comprize the float, and boulders have presented a recovery problem during placer mining activities. A single fineness value of 880 was obtained by the DGGS laboratory, from 2 grams of Fourth of July Creek gold. The bedrock consists of decomposed andesite and tuff of the Kvt unit, probably a poor catchment surface for placer gold. The present placer cut is in a high energy part of the stream valley with 250 m/km hydrologic gradiants. Better prospective pay could be possibly be found 2-3 km below the present operation at the canyon breakout, where the bedrock surface is Cretaceous clastic rocks. Also the stream in the lower valley has a more mature hydrologic gradient averaging 80 m/km; hence migration of heavy mineral placers may have stabilized.

A large, shallow, low-grade gold placer deposit near the head of Deadwood Creek was being developed by Don Harris during the 1984 season. According to Tovio Rosander (personal commun., 1983), the deposit was discovered in the late 1930s and consists of fine gold in shallow gravels 2-3 m thick with 1-3 m of overburden. Stripping of muck overburden was in process during 1984. The source of the gold is probably a former stream (now captured) draining the mineralized Maybe Creek pluton to the east.

Beneficition studies of low-grade chromite placers at Moore and Fourth of July Creeks are summarized in table 3; table concentrations of .23 and 2.08 percent Cr respectively, were obtained; these values are too low to be considered economically significant.

Sand and gravel deposits are widespread in terrace alluvium, fan-terrace, and modern floodplains deposits, should they be needed for future use. At least 2 million tons of high quality, washed, and stacked aggregate exist in the placer tailings of Moore Creek.

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DESCRIPTION OF MAP UNITS

Unconsolidated Deposits

Qa STREAM ALLUVIUM---Unconsolidated silt, sand and gravel deposited by modern streams and flood plains; commonly covered by sphagnum moss, and extensive willow-alder thicket concentrations in mature valley fills. Thickness highly variable.

Qht PLACER MINE TAILINGS---Symmetrical or irregular stacked piles of water-washed, sorted gravel and in situ slab rock derived from bedrock. Cobbles dominantly rounded mafic volcanic and intrusive rocks and minor sandstone and shale. Fine silt to clay fraction artificially removed during placer mining process. Generally 2-5 m thick in Fourth of July and Moore Creek drainages.

Qdt GLACIAL DRIFT---Unsorted diamicton deposited by glacial ice and glacio-fluvial processes. Stratified gravel, sand and silt range from 1-5 m thick in Maybe and Moose Creek valleys. Distal portions of deposits grade into undifferentiated colluvial deposits (Qu).

Qft FAN-TERRACE DEPOSITS---Composite unit of poorly sorted, partially stratified silt, sand, and gravel in alluvial-colluvial fans and moderately sorted, well stratified, sand and gravel in terrace alluvium. Vegetation and erosion makes contacts between units gradational. Qft probably formed by erosion of pediment uplifted by Nixon-Iditarod Fault, and locally includes alluvial aprons near stream cuts. Unit varies from 5-60 m thick.

Qsf SILT-FAN DEPOSITS---Moderately stratified silt, sand and minor stream gravels deposited by water along hill slopes and in stream gullies; generally a reworking of wind blown sand-silt deposits. Heavily vegetated and contacts with other Quaternary units based on airphoto interpretation.

Qat TERRACE ALLUVIUM---Poorly to moderately stratified sand locally cemented by iron oxides. Probably includes stripped strath terraces. Vegetated surfaces dissected by modern streams and mantled with eolian silt. Varies from 2-5 m thick throughout map area.

Qls LANDSLIDE DEPOSIT---Unsorted diamictic material consisting of angular bedrock blocks, vegetation mattes and stream gravels and colluvium believed to be transported downslope by mass failure.

Qu QUATERNARY DEPOSITS UNDIFFERENTIATED---Unconsolidated alluvial, colluvial, and eolian deposits. Eolian deposits locally ice rich in valley fill. Includes bedrock-derived talus and alluvial aprons on moderate to steep hillslopes. Contacts with other units commonly obscured by vegetation. Thickness highly variable and may reach 100 m near valley floors.

Volcanic and Sedimentary Units

Kvm MAFIC VOLCANIC ROCKS---Dark greenish-gray to maroon, aphanitic to fine-grained, porphyritic olivine-pyroxene basalt, basaltic andesite, and mafic agglomerate. Dominant pyroxene is euhedral augite with grains and phenocrysts up to 1 cm in diameter. Olivine often altered to antigorite. More mafic units commonly show a distinctive maroon to deep purple color. Columnar jointing well-expressed locally. Altered near Maybe Creek and Moose Creek plutons. Resistant and forms prominant outcrops on ridge tops.

Kva VOLCANIC AGGLOMERATE---Medium- to dark greenish-gray lapilli tuff and agglomerate containing elliptical bombs and sub angular to rounded fragments of basalt and andesite up to 100 cm in diameter. Moderately resistant. Chalcedony infillings in fractures and amygdules in specific localities are of agate grade.

Kvi INTERMEDIATE VOLCANIC ROCKS---Light- to medium-greenish-gray, aphanitic to fine-grained biotite-pyroxene andesite, dacite, agglomerate, and flow breccia. Unit contains approximately 50 percent agglomerate and flow breccia. Amygdules and fractures in andesitic flows commonly infilled with prehnite and chlorite. Quartz carbonate geodes containing agate locally developed in andesitic agglomerate. Moderately resistant.

Kvpi PORPHYRITIC ANDESITE---Medium-greenish-gray, porphyritic augite-andesite with feldspar phenocrysts up to 2 cm long that compromise up to 35 percent of rock unit by volume. Moderately resistant. Believed to be in fault contact with other volcanic units.

Kvt ALTERED INTERMEDIATE TO FELSIC VOLCANIC ROCKS AND SANDSTONE---Heterogeneous unit of light-tan to iron-red, aphanitic to fine-grained, altered andesite, dacite, and welded(?) tuff, with interbedded quartzose sublithic sandstone near base. Groundmass of many volcanic samples altered to silica (tridymite), carbonate and chlorite. Pseudomorphs of augite recognized in andesitic rocks. Fractures and amygdules infilled with prehnite, chlorite, quartz, and carbonate; distinctive green to dark-blue gem quality chalcedony infillings in fractures up to 20 cm wide in Moose Creek drainage. Termed 'gossan unit' in field because of iron-red color of most of unit. Believed to form a gradational contact with underlying Kfss and Kss units. Nonresistant.

Kfss FINE SUBLITHIC SANDSTONE AND SILTSTONE---Light gray, tan weathered, fine to very fine grained quartzose sublithic sandstone and medium gray plant rich siltstone. Point counts (N=6) shows subrounded, poorly sorted, tightly packed clasts consisting of combined chert and quartz (80 percent), white mica, (2-6 percent) plagioclase, (5 percent) volcanic grains, including pyroxene or hornblende (5 percent), opaques (1-2 percent) and shale-argillite rip-up fragments (1-4 percent). Siltstones characteristically rich in plant stems, leaf fragments, and rare Inoceramus shell fragments (table 10). Crossbedding in the form of stacked cosets 3-10 cm thick common in outcrop; graded bedding generally absent. Probably formed in shallow or marginal marine conditions near a shoreline with possible inclusion of nonmarine deposits. Estimated to be 500 m thick. Generally nonresistant.

Ksv VOLCANICLASTIC SANDSTONE---Medium greenish-gray, locally silicified, medium- to coarse-grained, volcaniclastic sandstone. Point counting (N=3) shows distinctly subangular clasts of dacite and andesite (20-25 percent), chert (20 percent), quartz (20 percent), felsite (15 percent), chlorite (5-8 percent), white mica (3-5 percent), and opaque minerals (6-10 percent). Clasts less tightly packed than in Kfss, Kss, and Ks units. Estimated to be 50-200 m thick but highly variable; is generally interbedded with Kcs unit. Generally resistant.

Kcs COARSE SANDSTONE AND CONGLOMERATE---Medium greenish-gray indurated, coarse-grained volcaniclastic sandstone with local beds 1-3m thick of pebble conglomerate. Clast composition and shape generally similar to that reported in Ksv unit. Interbedded micaceous siltstone. Point count estimates (N=3) show quartz and chert (65-80 percent), plagioclase (2-5 percent), volcanic clasts (5 percent), and undetermined opaques and oxidized matrix (10 percent). Locally BOUMA A-C intervals recognized. Inoceramus prisms locally abundant. Unit thickens and thins along strike and estimated to be 200-400 m thick. Very resistant relative to other units.

Ktls CALCAREOUS SANDSTONE AND SILTSTONE---Heterogenous unit consisting of gray to tan, tan weathered, fine- to coarse-grained, subangular to rounded, lithic, distinctly calcareous sandstone and interbedded micaceous siltstone. Point count studies (N=5) indicate chert (20 percent), quartz (20 percent), mica (6-7 percent), clinopyroxene(?) (5 percent), and undetermined mafic and opaques (8 percent) clasts in a surrounding matrix of undetermined carbonate (40 percent). Effervescence generally strong but somewhat variable depending on carbonate content. Unit conspicuously contains Inoceramus prisms, shell fragments and rounded plant stems. Contains rip-up clasts, graded A-C BOUMA intervals, and, locally, scour and fill features suggestive of deposition by turbidity currents. Calc-sandstone lithologies typical of this unit are also found in Kvs unit. Distinct tan weathering highly dependent on oxidized extent of outcrop or degree of dike swarm intrusion, which is locally conspicuous. Probably at least 600m thick. May be equivalent to Kst unit in Iditarod D-2 Quadrangle (Bundtzen and Laird, 1982).

Ks LITHIC SANDSTONE---Medium- to dark-gray, subangular to subrounded, medium-grained lithic sandstone, with minor siltstone and shale. Generally noncalcareous. Clasts (N=7) consist of chert (35 percent), quartz (30 percent), opaques (5-15 percent), white mica (2-4 percent), and argillite-slate intraclasts (15-20 percent). Volcanic and calcareous clasts generally uncommon or absent. Exhibits graded bedding, flute clasts, ripple marks, and ABCD-BCDE BOUMA intervals suggestive of deposition by turbidity currents. Effectively identical to most clastic lithologies found in undifferentiated unit south of Nixon-Iditarod Fault. About 150 m thick. Generally nonresistant.

Kus UNDIFFERENTIATED SEDIMENTARY ROCKS---Very heterogeneous unit consisting of fine to coarse, calcareous and noncalcareous sandstone, shale, and micaceous siltstone with characteristics inclusive of all previously described units but most similar to those of lithic turbidite sandstones described in Ks and Kcls units. Extensive Quaternary and vegetative cover prevented subdivision of unitss. Thickness unknown but at least 3,500 m south of the Nixon-Iditarod Fault. Generally nonresistant.

Ksh SHALE, SILTSTONE AND FINE SANDSTONE---Medium to dark gray, finely laminated, locally graded siltstone and shale with up to 15 percent fine grained lithic wacke. Thin BCDE BOUMA intervals present locally. Traces of burrowing organisms present in micaceous shale. Thickness unknown as base is not exposed, but at least 250 m. Very nonresistant

PzJc CHERT, CHERT BRECCIA, AND SANDSTONE---Poorly exposed, fault bounded sliver of medium gray to green, radiolarian(?) chert, light green volcaniclastic(?) fine sandstone, and gray chert breccia; believed to be equivalent to the chert-clastic-limestone unit (Pzs) in Iditarod D-1 Quadrangle which has yielded Middle Mississippian conodonts and Triassic to Jurassic radiolaria (Bundtzen and Laird, 1982, 1983a; M.L. Miller, unpub. information).

Metamorphic and Igneous Rock Units

TKf RHYOLITE TO DACITE---Light-gray, bleached, aphanitic to very fine grained, biotite-bearing quartz dacite, rhyolite, and alaskite. Color index (CI) = 3-5. Units intruding Moore Creek fault display highly trachytic texture and contain hyperstene, apatite, and corundum(?) as minor constituents throughout groundmass.

Km MONZONITE AND MONZODIORITE---Light- to medium-gray, fine- to medium-grained, porphyritic to locally equigranular, tourmaline-bearing olivine, biotite, augite monzonite. Feldspar phenocrysts commonly zoned in altered, finer grained groundmass; biotite rims augite. CI ranges from 15-40. Tourmaline rosettes up to 1 cm in diameter are particularly abundant in border phase. Very resistant and forms or underlies highest uplands in study area. Intrusive rock on Camelback Mountain is a conspicuous fine grained, phaneritic, olivine-augite monzonite containing up to 8 percent modal olivine.

Kqm QUARTZ MONZONITE---Light gray, medium grained equigranular, tourmaline bearing biotite, quartz monzonite. CI=10-20; forms prominant sill-like body in southern Beaver Mountains volcanic field. Distinguished from Km by lack of olivine and clinopyroxene and addition of significant amounts of quartz.

Kd DIKES UNDIFFERENTIATED---Gray to tan aphanitic to fine grained intrusive dikes of variable composition; usually extensively altered (table 4). Original compositions generally believed to have been mafic.

Khf HORNFELS---Brown to gray, massive to porphyroblastic, chlorite ± biotite hornfels locally tourmaline rich. Dark gray varieties locally difficult to distinguish from aphanitic mafic volcanic rocks of Kvm and Kvi units. Volcanic units at head of Maybe, Moose, and Moore Creeks have undergone extensive thermal alteration, but are not shown as hornfels.

Map Symbols

Contact---approximately located, queried where questionable.

High Angle fault---Solid where known, dashed where approximately located, queried where questionable, dotted where concealed. U, upthrown side; D, downthrown side; arrows show direction of relative movement.

Anticline, showing trace of axial plane and direction of plunge.

Syncline, showing trace of of axial plane and direction of plunge.

Strike and dip of beds

Inclined

Vertical

Uncertain

indicates general strike and dip of beds from aerial photographic interpretation

Strike and dip of foliation

Inclined

Vertical

Strike and dip of cleavage

Inclined

Vertical

Strike and dip of joints

Inclined

Vertical

Trend and plunge of lineation

Crenulation

Overturned isoclinal fold

K-Ar age-date locality (table 1)

Mineral occurrence or prospect (table 2, table 3)

Major-oxide analysis (table 4)

Paleocurrent direction (table 5)

Fossil locality (table 6)

Table 1. Analytical data for K-Ar determinations.

Map (field) number	1 (82BT392)	2 (82CL135)	3 (82BT399)	4 (82BT430)	5 (83BT76)	6 (84BT277)
Rock type	Augite basalt	Monzonite	Monzodiorite	Monzonite	Alaskite	Olivine basalt
Mineral dated	Plagioclase	Biotite	Biotite	Biotite	Whole rock	Whole rock
K_2O (wt %)	0.600	7.920	7.212	8.645	0.180	2.707
Sample wt (g)	1.4901	0.0743	0.0666	0.0719	2.0561	2.5645
$\frac{^{40}Ar_{(rad)}}{(moles/g)} \times 10^{-11}$	6.68	82.1	72.3	88.5	1.77	23.01
$\frac{^{40}Ar_{(rad)}}{^{40}K \times 10^{-3}}$	4.49	4.18	4.05	4.13	3.96	3.43
$\frac{^{40}Ar(rad)}{^{40}Ar(total)}$	0.353	0.718	0.439	0.416	0.371	0.335
Age ± 1 δ (m.y.)	75.7 ± 2.3	70.6 ± 2.1	68.3 ± 2.0	69.8 ± 2.1	67.0 ± 2.0 (minimum age)	58.13 ± 1.9 (minimum age)

Constants used in age calculations: $\delta_e + \quad_e = 0.581 \times 10^{-10}\ yr^{-1}$

$\delta_B = 4.962 \times 10^{-10}\ yr^{-1}$

$^{40}K/K_{total} = 1.167 \times 10^{-4}$ mol/mol

Analyses by J.D. Blum, DGGS - University of Alaska Cooperative Geochronology Laboratory, Fairbanks, Alaska.

Table 2. Analytical results of selected rock chip samples, Iditarod C-3 Quadrangle, Alaska. (Anomalous elements underlined)[1]

Map no.	Field no.	Cu	Pb	Zn	Ag	Au	As	Mo	Sb	Sn	W	Hg	Co	Ni	Cr	Mn	Fe
		ppm										ppb	ppm				(%)
1	82GL106	24	ND	38	ND	ND	ND	2	ND	ND	2	15	23	163	260	538	4.04
2	82BT385	51	5	60	0.2	ND	ND	2	ND	ND	3	3,700	25	105	378	347	4.99
3	82BT404	52	76	17	5.1	ND	33	2	13	ND	10	5,000	18	68	438	428	3.57
4	82BT405	36	9	33	0.2	ND	ND	1	ND	ND	2	260	28	120	380	754	4.98
5	82GL115	29	ND	10	0.2	ND	32	2	8	ND	2	1300	13	114	340	170	3.26
6	82GL119	31	17	64	0.5	ND	12	2	ND	ND	2	580	23	70	398	473	6.51
7	82GL118	19	3	19	0.2	ND	ND	1	ND	ND	3	100	16	48	271	1,210	3.05
8	82GL117	25	2	43	0.1	ND	ND	1	ND	ND	2	700	27	261	328	1,020	5.25
9	82GL113	42	2	60	0.3	ND	ND	2	ND	ND	2	50	16	48	234	659	3.76
10	82GL112	27	4	35	0.2	ND	102	2	ND	8	3	170	16	65	398	538	4.11
11	82BT396	43	7	45	ND	ND	ND	2	ND	ND	2	40	28	99	340	554	4.14
12	82BT398	44	9	29	0.5	ND	ND	2	ND	ND	3	1,300	25	65	265	622	3.70
13	82GL121	6	6	77	0.1	ND	ND	1	ND	6	2	190	ND	ND	127	33	0.86
14	82GL123	10	15	60	0.8	ND	ND	1	ND	ND	3	210	ND	ND	124	959	2.76
15	82GL130	19	12	64	0.3	ND	ND	1	ND	ND	3	40	24	111	474	1,130	4.29
16	83BT9	14	8	84	ND	0.2	ND	2	ND	1	1	280	11	36	114	116	1.50
17	83BT8	7	4	33	ND	ND	ND	2	ND	1	1	120	ND	12	190	232	3.15
18	83MSL29	34	16	80	ND	ND	ND	2	ND	2	1	250	ND	40	151	329	3.19
19	83GL3	42	7	76	ND	ND	ND	4	ND	1	1	140	10	43	12	15,800	22.70
20	83GL10	63	8	76	ND	ND	51	2	ND	1	1	3,400	44	419	315	539	6.70
21	83GL11	38	7	81	ND	ND	ND	2	ND	1	1	890	15	133	134	196	4.89
22	83BT4	27	8	81	ND	0.2	99	2	ND	1	1	1,500	14	85	184	298	5.03
23	83GL14	146	18	98	ND	ND	ND	2	ND	6	1	510	21	85	94	706	5.90
24	83BT2	30	7	74	ND	ND	14	2	ND	2	1	400	17	57	107	427	4.05
25	83BT20	17	7	39	0.2	0.2	ND	1	ND	1	1	2,500	ND	25	115	177	2.09
26	83MSL55	93	12	59	ND	ND	ND	1	ND	3	1	1,300	ND	43	150	364	4.91
27	83BT29	42	9	66	ND	ND	ND	2	ND	1	1	150	22	220	1,236	767	4.16
28	83GL28a	69	9	80	ND	ND	ND	2	ND	1	1	2,900	28	134	245	488	6.79
29	83BT82	146	5	47	ND	ND	ND	3	ND	1	1	50	13	29	31	612	3.39
30	83BT83	15	3	28	ND	ND	ND	3	ND	1	1	70	ND	13	164	4,540	4.08
31	83BT80	12	7	32	0.2	ND	ND	3	ND	1	1	140	ND	ND	43	260	0.78
32	83BT81	9	3	27	0.1	ND	24	3	ND	2	1	110	ND	12	166	981	1.14

Remarks
Ferricrete-stained fractures in mafic agglomerate.
Ferricrete gossan with abundant blue chalcedony in altered dacite.
Same as above.
Same as above.
Hornfels-tourmaline breccia zone adjacent to monzonite.
Ferricrete gossan in altered andesite.
Ferricrete gossan with blue chalcedony.
Same as above.
Hornfels zone in Cretaceous sandstone.
Fracture filling in monzonite near contact zone.
Epidotized fracture filling in basalt.
Ferricrete gossan in monzonite-hornfels contact zone.
Ferricrete zone in alaskite.
Same as above.
Iron-stained fracture filling in augite basalt.
Silicified zone near altered dike.
Pyrite bearing quartz vein in sand-stone.
Drusy quartz vein in shale.
Fe-Mn rich quartz vein in sandstone near altered dike.
Altered mafic(?) dike.
Dike rubble with vein material.
Altered porphyritic dike with vein.
Altered sandstone with minor dike.
Sheared gossan rich dike and shale.
Gossan bearing chert breccia.
Altered sandstone and shale.
Prospect pit with altered mafic dike.
Altered sandstone and shale.
Concretion rich shale.
Concretion rich pyrite bearing shale.
Fe stained shale with minor quartz vein.
Altered sandstone.

33	82BT430A	128	92	28	2.2	ND	413	2	10	-	-	-	ND	11	440	463	1.73
	82BT430B	137	161	29	4.1	ND	276	2	11	-	-	-	ND	ND	394	533	1.52
	82BT430C	905	670	159	17.3	ND	1,510	2	62	-	-	-	ND	ND	535	184	3.66
	82BT430D	4,860	1,430	760	555.0	1.6	5,590	4	2,400	-	-	-	ND	42	577	ND	3.90
	82BT430E	439	21	175	158.0	ND	821	5	14	-	-	-	ND	15	373	1,400	5.07
	83BT430F	360	940	83	9.7	0.4	ND	3	111	3	2	610	2	6	99	300	2.24
34	83BT62	19	4	46	0.4	0.3	ND	5	ND	1	1	ND	1	18	5	1,300	49.40
35	83GL82	26	4	77	ND	ND	ND	1	ND	2	1	160	25	57	115	333	3.45
36	83BT59	35	9	93	0.1	ND	ND	3	ND	2	1	1,200	135	88	1,587	737	5.88
37	83BT61	31	10	77	0.1	ND	ND	2	ND	1	1	300	ND	52	55	699	4.24
38	83GL47	138	24	83	0.4	ND	ND	ND	ND	1	1	110	ND	63	280	1,400	9.28
39	83GL59	891	18	304	2.6	ND	34	4	ND	6	1	400	17	57	ND	16,800	28.00
40	83GL53a	210	49	84	1.6	0.2	127	3	ND	3	1	3,000	ND	12	77	432	5.75
(b)	83GL53b	177	77	349	2.9	0.2	ND	3	ND	2	1	650	ND	23	109	569	5.54
41	83GL69	9	10	84	0.1	ND	ND	3	ND	1	1	5,100	16	ND	66	961	5.64
42	83GL73	19	4	51	ND	ND	ND	1	ND	2	1	280	ND	33	115	333	3.45

[1] Analyses by M.K. Polly, M.R. Ashwell, and T.A. Benjamin, DGGS Minerals Laboratory and by Bondar-Clegg Ltd., Vancouver, Canada. Cu, Pb, Zn, Ag, Au, Mo, Sb, Co, Ni, Cr, Mn, and Fe by inductively coupled plasma spectrophotometry. As by atomic absorption spectrophotometry. Pt, Nb, Bi, Hg, Sn, and W by x-ray flourescence. Underlined results indicate anomalous values obtained by inspection.

ND = Not detected

– = Not analyzed

Except where otherwise noted Pt, Nb, and Bi were looked for but not detected.

Chip channel samples of Broken Shovel silver-gold deposit; see figure 1.
430A-F from 1.2, 1.0, 0.8, 1.8, 1.3, and 1.0 m wide sampled zones respectively. 430F contains 78 ppm Bi.

Iron rich concretions in shale-sandstone.
Altered dike and sandstone.
Pyrite bearing sandstone and mafic dike.
Ferricrete gossan in shale.
Hornfels with pyrite.
Massive pyrrhotite 25 cm wide at Khf-Km contact.
Fe stained sandstone in fault.
Fault breccia with sulfides.
Fe stained shale(?) with wood chips.
Dike rubble.

Table 3. Summary of beneficiation results from Moore and Fourth of July Creek chromite bearing placer deposits, Alaska.[1]

Moore Creek (84BT89)

		(wt %)					(ppm)		
	(wt kg)	Ni	Fe	Co	Cr	Ti	Pd	Au	Ag
Heads	33.60	.02	10.3	.04	.07	.59	ND	ND	- -
Table conc. (-28 mesh)	.192	.02	8.25	ND	0.23	.52	.07	14.3	6.12
Coarse table conc.	3.54	- -	- -	- -	.06	- -	.04	ND	.68

Fourth of July Creek (84BT90)

		(wt %)					(ppm)		
	(wt kg)	Ni	Fe	Co	Cr	Ti	Pd	Au	Ag
Heads	33.41	.03	8.42	.05	.17	.53	ND	ND	ND
Table conc. (-28 mesh)	.145	.04	9.27	.05	2.08	.90	ND	8.97	2.6
Coarse table conc.	2.17	- -	- -	- -	- -	- -	.06	ND	8.5

[1]Seventy-five kilogram/gravel samples from both sites were collected by Bundtzen and Lockwood, on or near bedrock 'pay' surfaces in unmined placer gravels; no field beneficiation was attempted. Samples were subsequently shipped and processed at the U.S. Bureau of Mines Research Center in Albany, New York. Of the platinum metals only palladium was detected---in trace amounts.

Table 4. Major-oxide analyses[a] and CIPW norms of igneous rocks, Iditarod C-3 Quadrangle, Alaska.

Map number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Field number	82GL105	82GL107	82BT397	82BT396	82GL121	82BT409	82BT415	82BT410	Camp 2	82GL136	82BT428	82BT439	82BT437	83BT89	83BT72	83BT48	83MSL45
Rock type	Augite Basalt	Andesite	Quartz Monzonite	Olivine Basalt	Rhyolite	Altered Dacite(?)[b]	Altered Andesite[b]	Andesite	Andesite	Olivine Basalt	Silicified Monzonite	Andesite	Quartz Monzonite	Augite Basalt	Dacite	Tonalite	Dacite[b]
SiO_2	54.64	59.66	63.53	53.77	72.14	50.67	51.07	57.07	56.27	51.49	80.63	57.01	57.13	54.12	61.64	54.14	49.32
Al_2O_3	10.83	14.11	14.42	11.63	14.71	10.69	11.28	13.59	14.40	10.52	8.39	18.03	15.16	11.78	17.76	11.14	12.00
Fe_2O_3	2.90	1.47	1.27	1.09	0.41	2.76	3.23	3.25	4.38	1.80	1.83	3.94	1.60	2.83	1.29	3.01	3.00
FeO	5.68	5.75	3.84	7.54	0.78	3.71	4.16	3.64	2.39	7.32	2.18	1.97	3.99	5.77	3.80	7.09	5.25
MnO	0.16	0.14	0.11	0.16	0.01	0.31	0.11	0.13	0.06	0.17	0.03	0.09	0.14	0.16	0.05	0.23	0.12
MgO	11.06	6.16	4.00	12.68	0.25	6.49	6.95	8.17	6.53	13.10	1.45	0.80	3.37	8.98	1.37	10.98	7.86
CaO	7.66	4.92	3.61	6.66	0.72	5.71	4.21	6.41	6.76	8.93	0.43	5.02	5.29	8.52	5.57	6.25	6.58
Na_2O	1.69	2.63	2.65	2.02	3.59	0.23	0.34	2.25	2.50	1.63	0.96	3.57	2.39	2.04	4.05	1.19	2.18
K_2O	3.07	3.74	3.72	2.73	4.35	4.67	3.57	3.28	3.12	2.95	1.37	3.91	3.64	2.75	2.24	1.13	1.66
TiO_2	0.64	0.77	0.70	0.73	0.12	0.64	0.76	0.66	0.76	0.69	0.78	1.27	0.71	0.70	0.60	0.68	0.73
P_2O_5	0.35	0.28	0.21	0.28	0.04	0.28	0.27	0.28	0.27	0.34	0.11	0.54	0.31	0.35	0.30	0.29	0.22
H_2O	0.44	0.44	0.71	0.19	0.10	0.21	0.26	0.53	0.91	0.23	0.19	0.37	0.17	0.30	0.93	0.68	0.47
LOI	1.46	1.10	0.67	1.54	1.53	14.94	15.31	2.00	2.18	0.60	2.51	2.43	5.80	1.45	1.11	3.34	11.06
Total	100.38	100.67	98.94	101.02	98.75	101.31	101.52	101.26	100.53	99.77	100.86	98.95	99.70	99.45	99.88	99.47	99.98

[a] Analyses by X-ray Flourescence, DGGS Minerals Laboratory.
[b] Petrographic analyses indicate ubiquotous alteration of mafic dikes (Kd) and volcanic rocks in Kvt unit; high loss on ignition renders norm calculations questionable for these selected analyses.

Quartz	2.56	9.24	18.49	0.00	32.40	11.27	15.18	7.61	9.17	0.00	66.46	10.85	12.43	7.91	15.69	10.73	4.69
Orthoclase	18.14	22.10	21.98	16.13	25.70	27.59	21.09	19.38	18.44	17.43	8.09	23.10	21.50	16.25	13.[illegible]	6.68	9.80
Albite	14.29	22.25	22.42	17.09	30.38	1.95	2.88	19.03	21.15	13.79	8.12	30.20	20.22	17.26	34.26	10.07	18.44
Anorthite	12.89	15.64	16.46	14.60	3.31	14.34	18.71	17.29	18.86	12.68	1.42	21.37	19.88	14.86	23.66	21.72	18.05
Nepheline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diopside	18.19	5.40	0.06	13.35	0.00	9.66	0.33	10.07	10.05	23.57	4.87	0.00	3.52	20.15	1.64	5.95	10.56
Hypersthene	26.15	20.04	14.98	27.53	1.54	15.29	21.07	18.77	11.60	12.18	0.00	1.90	11.76	20.59	5.08	35.07	21.62
Olivine	0.00	0.00	0.00	6.96	0.00	0.00	0.00	0.00	0.00	14.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magnetite	4.26	2.13	1.84	1.58	0.59	4.00	4.68	4.71	5.67	2.61	2.65	2.96	2.32	3.19	3.04	3.16	3.23
Ilmenite	1.21	1.46	1.33	1.39	0.23	1.21	1.44	1.25	1.44	1.31	1.48	2.41	1.34	1.32	1.14	1.30	1.39
Corundum	0.00	0.00	0.00	0.00	2.88	0.00	0.00	0.00	0.00	0.00	4.80	0.09	0.00	0.00	0.00	0.00	0.00
Differentiation Index	35.01	53.59	62.89	33.22	88.47	40.81	39.01	46.03	48.71	31.22	82.67	64.16	54.16	36.41	63.19	27.47	32.94

18	19	20
83CL88	84BT777	85BT100
Altered	Olivine	Olivine
Rhyolite	Basalt	Basalt
75.97	54.95	54.37
9.37	11.31	12.04
1.70	2.12	2.16
4.10	5.43	5.97
0.07	0.16	0.17
2.19	11.28	9.28
0.85	6.68	8.68
1.53	1.79	1.85
1.00	2.83	2.64
0.71	0.62	0.66
0.13	0.33	0.40
0.42	0.50	0.00
3.25	1.64	1.67
100.87	99.64	99.84

57.13	3.767	3.556
4.54	17.157	15.887
5.91	15.534	15.936
12.95	14.839	17.054
3.37	0.000	0.000
0.00	13.511	19.173
8.51	30.054	27.794
0.00	0.000	0.000
3.20	3.153	3.168
1.34	1.708	1.276
4.54	0.000	0.000
75.98	36.45	35.37

Table 5. Paleocurrent data from Cretaceous sedimentary rocks, Iditarod C-3 Quadrangle, Alaska.[1]

Map (field) no.	Azimuth (corrected for tilt)	Grand mean	Flow regime
1 (83BT11)	70°	50.6	lower
	68°		
	14°		
2 (83BT16)	10°	18.7	lower
	20°		
	15°		
	30°		
3 (83BT18)	240°	237.5	upper
	235°		
4 (83BT61)	210°	200.5	upper
	200°		
	204°		
	188°		
5 (83BT86)	160°	144.2	upper
	145°		
	162°		
	110°		
6 (83BT87)	230°	241	upper
	225°		
	245°		
	240°		
	265°		

[1] Measurements on striations, groove casts, flow casts, and cross-beds by T.K. Bundtzen.

Table 6. Fossil Identifications in the Iditarod C-3 Quadrangle, Alaska.[1]

Map Number	Field Number	Location and description of collection site	Fossil identification and age estimate
1	83BT16	62° 44' 02" N lat.; 157° 27' 30" W long.; along cutbank of Dishna River.	Shale-fine sandstone section contains abundant wood chips, dicotyledon leaf fragments and conifer needles of the Cretaceous form Cephalotaxopsis heterophylla.
2	82BT402	62° 42' 50" N. lat.; 157° 07' 50" W long.; just off of upper right limit tributary of Maybe Creek at 1520'.	Sublithic, tan weathered quartzose sandstone contains near complete specimen 15 cm long of Inoceramus hobetsensis of Late Cretaceous (Turonian) age.
3	83BT87	62° 35' 48" N lat.; 157° 05' 20" W long.; along north cut of Moore Creek 2 km downstream from end of placer tailings.	Classic turbidite section in Kus contains abundant fragments and nearly complete specimens of dicotyledon leaves of Late Cretaceous age.
4	83GL30A	62° 37' 30" N lat.; 157° 28' 40" W long.; along N trending ridge at 1200'.	Fine-grained volcaniclastic sandstone contains abundant dicotyledon leaves commonly found in North American flysch of Albian or younger age.
5	83BT46	62° 34' 00' N lat.; 157° 22' 50" W long.; along NW ridge of Camelback Mtn. at 2150'.	Inoceramus shell fragments of Cretaceous age; Mertie (1936) reported Inoceramus pelecepods of Late Cretaceous age from this locality.

[1]Floral identifications by C.J. Smiley, University of Idaho, Moscow, Idaho; faunal identifications by John W. Miller, U.S. Geological Survey, Menlo Park, California.

6	83BT47	62° 33' 40" N lat.; 157° 22' 45" W long.; about 1 km SW of 83BT46.	Calcareous sandstone and siltstone contains abundant dicotyledon leaf debris and a small fern similar to Asplenium foersteri of Hollick (1930).
7	83MSL48	62° 33' 00" N lat.; 157° 26' 40" W long.; along summer trail 2 km SW of Black Pass.	Siltstone contains large leaf fragments of the Laura family; these have an age range of mid-Cretaceous to Early Tertiary.
8	83MSL51	62° 32' 00" N lat.; 157° 28' 20" W long.; at 2152'.	Calcareous sandstone contains Inoceramus prisms of Jurassic or Cretaceous age.
9	83BT59	62° 31' 00" lat.; 157° 20' 00" W long.; about 3 km south from Camelback Mtn. at 1500'.	Shale-siltstone zone 20 m thick in sandstone section. Contains Inoceramus shell fragments, of Jurrassic or Cretaceous age.
10	83GL61	62° 31' 30" N lat.; 157°18' 00" W long.; near head of Bonanza Creek at 1500'.	Coarse sandstone and pebble conglomerate contain abundant Inoceramus prisms and shell fragments of Inoceramus hobetsensis of Late Cretaceous (Turonian) age.
11	83BT71	62° 30' 40" N lat.; 157° 10' 00" W long.; at bend in George River.	Inoceramus sp. of Cretaceous age.