DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

TO ACCOMPANY MAP I-455

GEOLOGIC MAP OF THE FAIRBANKS QUADRANGLE, ALASKA

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DESCRIPTION OF MAP UNITS

UNCONSOLIDATED SEDIMENTARY DEPOSITS

Qa *Flood-plain alluvium.*—Well-stratified layers and lenses of unconsolidated gray silt, sand, pebbles, cobbles, and boulders; occurs as two facies: (1) gravelly facies on Tanana River east of mouth of Chena River and on other streams in and near Alaska Range; (2) silt and silty sand facies on Tanana River west of mouth of Chena River, on streams north of the Tanana, and on lower courses of some streams draining Alaska Range. Gravelly facies contains pebbles, cobbles, and boulders, from ¼ inch to 3 feet in diameter, of resistant rocks from neighboring uplands, and is locally perennially frozen. Ice content low. Sand and silty sand facies contains swale and slough deposits consisting of poorly stratified lenses and layers of fairly well-sorted stream-laid silt and silty sand, composed mostly of angular to subrounded grains of quartz, mica, and feldspar, 10 to 30 percent clay, and some organic material. This facies is colored mottled brown to grayish blue by carbonaceous material and iron staining. Swale and slough deposits are perennially frozen and have moderate to high ice content.

Qs *Swamp deposits.*—Dark-brown to black peat and silt more than 5 feet thick in areas of impeded drainage in which standing water is present throughout the year. Perennially frozen and contain lenses and veinlets of clear ice. Many small swamps and seasonally flooded areas are included in map units Qa, Qab, Qaf, Qtf, Qsu, and Qho.

Ql *Landslide debris.*—Chaotic masses of angular fragments of shale, sandstone, conglomerate, clay, sand, gravel, and schist embedded in a matrix of silt, clay, and gravel, resulting from slumps and flows along cuesta and terrace escarpments and other oversteepened slopes. Characteristic irregular hummock and hollow topography with cracks, areas of water-saturated clay, and ponds. Some landslides are active; others would be reactivated by degradation of permafrost within them.

Qg *Reworked creek gravel.*—Placer-mine dredge tailings derived from buried creek gravels. Creek gravel from which the dredge tailings were derived underlies large areas of undifferentiated perennially frozen silt (Qsu), rests on Birch Creek Schist and intrusive rocks (Mzi) and, where exposed in walls of excavations, consists of well-stratified layers and lenses of poorly sorted angular to subrounded brown to buff, locally heavily iron-stained, auriferous sandy gravel, containing boulders of quartz, gneiss, and schist as much as 24 inches in diameter. Locally perennially frozen, with little ground ice.

Qbc *Basaltic cinders.*—Cinder cone from late Pleistocene or Recent eruption at north base of mountain southwest of Buzzard Creek, a headwater of Totatlanika River. Unconsolidated poorly sorted aggregate of irregular to subrounded fragments of scoriaceous to dense basalt. Fragments range from 3 inches or larger at crater rim to 0.5 to 1 inch 1.5 miles northeast of crater. Basalt is dark gray to black and composed of about 20 percent olivine in well-formed unembayed phenocrysts 0.25 mm in diameter, 20 to 25 percent calcic labradorite or sodic bytownite laths 0.1 mm long and 0.02 mm thick, and 5 percent clinopyroxene, set in a largely glassy brownish-gray groundmass containing fine opaque particles. Scattered broken crystals of orthoclase and quartz, apparently picked up from Totatlanika Schist, are present. Deposit is 100 to 200 feet thick at crater rim, thinning to a feather edge 1 mile northeast. No cinders on mountain to southwest. Cinders rest on youngest terraces on Buzzard Creek, which are correlated with the Riley Creek glaciation.

Qab *Abandoned flood-plain alluvium.*—Well-stratified layers and lenses of unconsolidated gray silt, sand, pebbles, cobbles, and boulders. Occurs in two facies: (1) coarse gravelly alluvium, indicated by pattern of small circles, which was deposited close to the Alaska Range and grades northward into (2) silty alluvium (shown without pattern) containing 95 percent silt and 5 percent sand, mantled by eolian silt and sand. The silty alluvium ranges in color from light to dark gray through buff to brown; it includes much organic material and grades into swamp deposits in poorly drained low areas; it also forms the natural levees. Many narrow discontinuous abandoned stream-channel deposits, consisting chiefly of washed medium- to fine-grained sand and minor amounts of gravel, cross the silty alluvium from south to north in the area between the Teklanika and Wood Rivers. The top of permafrost is 2 to 4 feet below the surface throughout areas of silty alluvium between abandoned stream channels, but is more than 10 feet deep beneath the channels. Ice content of silty alluvium is moderate to high.

Qaf *Alluvial-fan deposits.*—Well-stratified layers and lenses of gray to brown coarse sand and pebble, cobble, and boulder gravel. Deposits range in coarseness from sand in the area north and east of Blair Lakes (shown unpatterned) to cobble gravel close to the Alaska Range (shown with pattern of circles). Boulders 18 inches in diameter common within 10 miles of mountains. Cobbles and boulders are of granite, granodiorite, conglomerate, sandstone, schist, gneiss, quartz, and gabbro. Locally perennially frozen; ice content low. Areas within the Alaska Range shown by this pattern are alluvial terraces correlated with the Riley Creek Glaciation.

Qdr *Dune Sand, reworked.*—Organic silty sand underlying undrained depressions and old lake or pond beds; derived from nearby sand dunes. Silt and organic content vary considerably, and locally this unit grades into swamp deposits. Permafrost and considerable ground ice probably present at shallow depths.

Qrm *Morainal deposits of Riley Creek Glaciation.*—Unsorted and unstratified glacial till with silt cover ½ foot thick. Silt, sand, and gravel with boulders more than 3 feet in diameter. Coarse fragments angular to rounded. Permafrost present, ice content low to moderate. May contain large masses of glacially deformed Nenana Gravel. Mapping based largely on topographic expression. Riley Creek Glaciation probably correlates with Wisconsin Glaciation of mid-Continental United States (Wahrhaftig, 1958, p. 56).

Qro *Outwash of Riley Creek Glaciation.*—Well-stratified well-sorted porous and very permeable gray to pale yellowish-brown sandy gravel containing lenses of coarse well-sorted

sand. Average pebble diameter 1 to 6 inches, maximum 4 to 15 inches. Pebbles and boulders are of sandstone, conglomerate, schist, gabbro, granite, volcanic rocks, quartz, chert, and other rock types present in Alaska Range. Silt cover, which may be as much as 4 feet thick, indicated by stippled pattern. Locally perennially frozen, ice content low.

Qtf *Torrential fan deposits.*—Interfingering cobble and pebble gravel, mudflow deposits, and minor amounts of silt and sand, bordering the foothills. Average coarseness decreases away from foothills. Surface mantled with windblown and waterlaid sand and silt, but generally well drained. Seasonally swampy where fans join. Depth to permafrost and ice content of deposits unknown except between the Totatlanika and Nenana Rivers, where top of permafrost is at least 4 feet, and probably 15 feet, beneath surface (Kachadoorian, 1960).

Qf *Fairbanks Loess.*—Massive, homogeneous eolian silt on upper slopes and hilltops. Well sorted, less than 10 percent clay; grains angular, consist mostly of quartz, feldspar, and mica; locally cemented by iron oxide; locally calcareous. Thickness north of Tanana River ranges from 3 feet on upper hillslopes to a maximum of 200 feet on lower hillslopes; south of Tanana River thickness ranges from 3 to 50 feet. Not mapped on hilltops or slopes where less than 3 feet thick. Color buff to tannish-gray when dry, brown when wet. Locally mottled by iron staining and carbonaceous material. Contains a few thin (¼- to 6-inch) white volcanic ash beds in the Fairbanks area. Remains of middle to late Quaternary land mammals present. No permafrost except in southwestern corner of quadrangle where loess covers flat, poorly drained surfaces.

Qsu *Perennially frozen silt, undifferentiated.*—Massive, homogeneous unconsolidated well-sorted silt of eolian origin with less than 10 percent clay, locally rich in organic silt and larger organic fragments, retransported from original hillside sites of eolian deposition to lower slopes and valley bottoms by mudflows, gullying, and slopewash. Inorganic components are angular grains of quartz, feldspar, and mica, locally cemented by iron oxides. Inorganic silt is buff to brown or gray, locally mottled by organic matter and iron staining. Organic silt is brown to grayish black. Deposit incorporates large quantities of plant and animal remains in valley bottoms (including abundant remains of late Quaternary land mammals), and includes large oval areas of frozen peat chiefly composed of sphagnum mosses, as well as large masses of undecomposed or partially decomposed leaves, twigs, stems, and branches of higher plants. Permafrost 3 to 200 feet thick in valley bottoms creates poor drainage. Ground ice is abundant as horizontal and vertical sheets, vertical wedges, and saucer-shaped and irregular masses 1 to 50 feet in diameter. Thaw lakes and polygonal ground common.

Qd *Dune sand.*—Well-sorted, angular to round, moderate yellowish-brown eolian sand consisting mainly of yellowish-white, clear to opaque quartz grains (65 to 85 percent), but including some dark-gray to black rock fragments, chert, and mica (common in some areas), and traces of feldspar and light-colored rock fragments. West of the Teklanika and south of the Tanana, dune sand covers a broad area to a depth of 5 to 200 feet and occurs chiefly in longitudinal but locally parabolic dunes whose form and structure indicate deposition by northeasterly winds. Dunes are covered by eolian silt as much as 3 feet thick. Isolated dunes on alluvial and outwash plains east of the Teklanika and north of the Tanana. Permafrost absent or at considerable depth.

Qhm *Morainal deposits of Healy Glaciation.*—Unstratified glacial till with silt cover ½ foot to 3 feet thick. Silt, sand, and gravel with boulders more than 3 feet in diameter. Coarse fragments angular to rounded. Mapped from aerial photographs on basis of topographic expression; lithology based on comparison with morainal deposits of Healy age in the adjacent Healy quadrangle. The Healy Glaciation may correlate with the Illinoian Glaciation of mid-continental United States.

Qho *Outwash of Healy Glaciation.*—Coarse, clean, well-sorted, well-stratified gray- to yellowish-brown porous and very permeable gravel with layers and lenses of coarse clean sand. Gravel along Nenana River averages ½ to 3 inches, contains boulders as much as 1 or 2 feet across, and consists of sandstone, conglomerate, gabbro, granite, quartz-sericite schist, orthoclase-quartz-sericite schist, and gneiss. Gravel is locally perennially frozen and has low ice content, but is overlain by 2 to 6 feet of silt which is generally perennially frozen and has moderate ice content. West of Blair Lakes this unit contains cobbles as much as 6 inches in diameter consisting of gray granitic rocks, gneiss, volcanic rocks, and quartz, and is overlain by as much as 4 feet of silt, indicated by stipple pattern. Locally it is perennially frozen but contains little ground ice.

Qha *Alluvial fan deposits contemporaneous with Healy Glaciation.*—On the Dry Creek fan these deposits consist of well-stratified gray to brown pebble, cobble, and boulder gravel with layers and lenses of coarse sand, and range from fine clean gravel with pebbles ½ inch to 3 inches in diameter at north end of fan east of Blair Lakes to gravel with cobbles 8 to 12 inches in diameter south of Blair Lakes; boulders as much as 18 inches in diameter common close to mountains. Pebbles, cobbles, and boulders composed of gray granitic rocks, conglomerate, schist, gneiss, diorite, and quartz. Gravel locally perennially frozen; ice content low. In valleys in Alaska Range these deposits consist of interbedded gravel, sand, silt, and mudflow deposits derived from nearby mountains of Nenana Gravel and Totatlanika Schist. Locally they may be perennially frozen and contain little ground ice. Silt cover more than 4 feet thick is indicated by stippled pattern.

Qdm *Morainal deposits of Dry Creek Glaciation.*—Mapped from aerial photographs on basis of topographic expression. Probably similar to morainal deposits of Healy Glaciation but somewhat more weathered and eroded.

Qdo *Outwash of Dry Creek Glaciation.*—Similar to outwash of Healy Glaciation on same stream but more weathered and eroded, and overlain by thicker deposit of windblown silt.

Qda *Alluvial fan deposits contemporaneous with Dry Creek Glaciation.*—Similar to alluvial fan deposits contemporaneous with Healy Glaciation on same stream but more weathered and eroded, and overlain by thicker deposit of windblown silt.

Qbm *Morainal deposits of Browne Glaciation.*—Coarse sand and gravel, with abundant blocks of granite, gabbro, and conglomerate several feet on a side. Small areas at altitudes of 2,200 feet west of Windy Creek and 5,000 feet southeast of Gold King Creek consist largely of boulders and blocks.

Includes erratics (Qbe)—isolated angular blocks and groups of blocks of granite, gabbro, and conglomerate, 3 to 30 feet in diameter, resting on present topography. Apparently derived from headwater regions of Nenana and Wood Rivers in Alaska Range and deposited by ancient glaciers that flowed north over former valley floors much higher than present river beds. Ancient valley floor of Nenana River is 500 feet above present river level at Rex and 1,000 feet above river level at Ferry (Wahrhaftig, 1958, p. 22–28); ancient Wood River followed approximately the course of Gold King Creek in valley now about 2,000 feet above present river level at south border of quadrangle.

Tn *Nenana Gravel.*—Buff to reddish-brown poorly consolidated pebble to boulder conglomerate and coarse sandstone, with interbedded mudflow deposits, thin claystone layers and local thin lignite beds. Maximum thickness in Fairbanks quadrangle about 2,000 feet. West of California Creek includes several hundred feet of coarse sandstone at base; east of California Creek entire formation is conglomerate. Thickness and pebble size decrease northward; imbrication and crossbedding indicate deposition by north-flowing streams. West of Totatlanika River pebbles and boulders consist of sandstone and conglomerate from Cantwell Formation (Lower Cretaceous), quartz, chert, quartzite, volcanic rocks, granite, and granodiorite from plutons in Alaska Range to the south; and dark-green altered ophitic ilmenite-bearing gabbro from belt of Triassic greenstone in southern part of central Alaska Range. Between Totatlanika River and Gold King Creek Nenana Gravel consists entirely of clasts of Birch Creek and Totatlanika Schists, derived from mountains less than 15 miles to south. East of Gold King Creek clasts include Birch Creek and Totatlanika Schists, granitic rocks, sandstone and conglomerate of Cantwell Formation, and Triassic gabbro from head of Wood River. Unit perennially frozen, but contains little ground ice. According to Jack A. Wolf (written communication, March 19, 1964), age of Nenana Gravel, based on plant remains, is Pliocene(?).

Structure contours on base of Nenana Gravel show the inferred configuration of the surface (in part restored) on which it was deposited. In constructing contours east of California Creek and south of Buzzard and Boulder Creeks, thickness of coal-bearing formation beneath Nenana Gravel was assumed to be 500 to 700 feet. A synclinal basin of coal-bearing rocks with maximum thickness of 1,000 feet is believed to have underlain Nenana Gravel in area immediately north of Rex Dome, as inferred from single patch of coal-bearing formation on ridgetop north of mouth of Rex Creek.

Tcb *Coal-bearing formation.*—Poorly consolidated readily eroded pebbly sandstone, claystone, and subbituminous coal, in synclinal basins in the foothills of the Alaska Range between Nenana River and Dry Creek. Pinches out northward and is overlapped unconformably by Nenana Gravel. Can be divided into five units, locally separated by unconformities: (1) At the base, a discontinuous unit 600 feet thick in Rex Creek and MacAdam Creek basins, 160 feet thick at the head of Tatlanika Creek, and less than 100 feet thick elsewhere, of interfingering lenticular poorly sorted clayey pebbly sandstone, sandy micaceous claystone, and lenticular and locally bony coal. Clastic rocks were derived locally, and unit was deposited on irregular land surface. Prominent coal bed 24 feet in maximum thickness at top. (2) A 100-foot unit of yellowish-brown-weathering laminated gray claystone. (3) A 500- to 1,000-foot unit of clean white-weathering cross-bedded sandstone, coarse and pebbly at base, grading upward into greenish-gray silt and clay and topped by a laterally persistent coal bed 3 to 20 feet thick. Pebbles in sandstone are chiefly quartz, chert, and quartzite. (4) A 500- to 800-foot unit of clean buff cross-bedded pebbly sandstone, grading upward into a section of greenish-gray siltsone and claystone with several thin lenticular coal beds, generally less than 5 feet thick (one bed on Tatlanika Creek is 17 feet thick). Pebbles of granitic, gabbroic, and volcanic rocks are common to abundant. This unit grades northwestward into non-coal-bearing facies as much as 1,300 feet thick, consisting of sandstone and conglomerate; it overlaps units 1 to 3, apparently with local unconformity, and rests directly on schist west of California Creek and north of Buzzard and Hearst Creeks. (5) At the top, interbedded dark carbonaceous siltstone and claystone and dark sandstone, locally pebbly, totaling 1,000 to 1,500 feet in thickness between Tatlanika Creek and Wood River; pinches out abruptly westward between Tatlanika Creek and Totatlanika River. Near base of unit 5 on Tatlanika Creek are one or two discontinuous rhyolitic ash beds 0 to 25 feet thick. All units are perennially frozen to depths of 5 to 200 feet and have low to moderate ice content. Units 1 to 4 are thicker and contain more coal in adjacent parts of Healy Quadrangle to south. Areas of outcrop of non-coal-bearing facies of unit 4 and all of unit 5 are shown by stipple pattern.

Mt *Totatlanika Schist.*—Predominantly quartz-microcline-sericite schist and augen gneiss, gray in color, consisting of a coarse facies with large deformed phenocrysts of microcline, quartz, and rare albite 0.1-1 inch in diameter, in schistose groundmass of sericite, chlorite, quartz, feldspar, and calcite; interbedded with a fine facies consisting of angular grains of feldspar and quartz 0.01 to 1.0 inch in diameter, in a dark-gray to yellowish-gray schistose groundmass of sericite and chlorite. Contacts between the two facies are generally sharp. Augen are locally deformed into spindles, parallel to schistosity, elsewhere original crystalline outlines are at a sharp angle to schistosity. Locally contains layers of black carbonaceous schist 10 to 20 feet thick. In mountains between the head of Buzzard Creek and Wood River, the coarse facies (schist and gneiss) is separated by a thrust fault from an underlying third facies consisting of pale-yellow quartz-feldspar gneiss, with infaulted and interbedded black carbonaceous schist and dark-green chloritic schist. Foliation of Totatlanika Schist is due to parallel orientation of mica and chlorite flakes and fine layers of different mineral composition; lineation is commonly a linear streaking and elongation of some of the minerals, particularly the microcline augen, in a single direction in the plane of foliation. The permafrost is cut by two or three sets of joints, trending roughly N to NW, NE, and due E, spaced 1 to 6 feet apart and perpendicular to foliation. Totatlanika Schist is considered to be Mississippian(?) in age, on the basis of *Syringopora* (Wahrhaftig, 1968, p. 12).

DSt *Tolovana(?) Limestone.*—Thick-bedded to massive, fine-crystalline to lithographic, medium dark bluish-gray (rarely light bluish-gray) limestone of unknown thickness. Forms prominent ridge in extreme northwest corner of quadrangle. Weathers buff to yellowish brown. Contains crushed zones recemented by white calcite and quartz. Chert rare or absent. Correlated on basis of lithology and geographic trend with the Tolovana Limestone in the White Mountains 90 miles to the northeast, which is 4,000 feet thick at the type locality (Church and Durfee, 1961), and is Middle Silurian to Middle or early Late Devonian in age (Mertie, 1937, p. 89; Helen Duncan written communication, July 10, 1961; W. A. Oliver, written communication, February 13, 1961 and July 6, 1961).

Nilkolka Group.—The group consists of the following units, which are believed to be progressively older in the order given:

mc *Chert and siliceous shale.*—Chert is hard, thin bedded to blocky, locally cut by shear planes, medium light gray or rarely nearly white or black with thin color layering; commonly stained yellow or red by iron oxide from weathering; forms reddish soil. Interbedded siliceous shale is hard, thin bedded, medium light gray weathering to light yellowish gray.

ng *Grit, argillite, quartzite, and limestone.*—Interbedded grit and variegated clay slate, quartzite, and phyllite, with rare siltstone beds and a few fine-grained lenticular limestone beds as much as 5 feet thick. Color of fine-grained rocks predominantly green but mottled by red through pale olive green, dusky yellow, and light yellowish gray areas produced by leaching and oxidation along joints, on exposed surfaces, and in more porous parts. Siltstone green or tan; limestone medium gray to dark gray-brown, or creamy where weathered. Grit composed predominantly of rounded grains, ¼ inch in maximum diameter, of clear bluish quartz, light-colored microcline and plagioclase, and rare light-colored chert, embedded in a siliceous matrix; locally grades into coarse quartzite. Grit is gray but stained rusty brown on weathered surfaces. Locally the rock is foliated, generally parallel to bedding. The fine-grained rocks range from shale and argillite to phyllite.

In the Nilkoka Group the chert and shale (nc) alternate in bands several miles wide with grit and phyllite (ng). The Nilkoka is the underlying bedrock in most of the area west of Tolovana River and north of the Tanana; type locality is west bank of Tanana downstream from mouth of Tolovana (Brooks, 1900, p. 472). Unit nc is correlated with Mertie's (1937, p. 65–76) unit B, which may be Cambrian or Ordovician, on basis of fossils found in upper part of unit (Mertie, 1937, p. 73); unit ng is correlated with Mertie's pre-Ordovician unit C and possibly part of his late Precambrian unit D. Age of Nilkoka uncertain, but is believed to be Precambrian or early Paleozoic.

bc *Birch Creek Schist.*—Light- to dark-gray, reddish-brown to tan-weathering schists, predominantly quartz-sericite schist and micaceous quartzite. Includes muscovite-biotite schist, garnet-mica schist, calcite- and dolomite-bearing schist, dark-gray to black chloritic and graphitic schist, amphibolite, light-gray to white impure marble, and light-brown (light-gray-weathering) gneiss that has been affected by retrograde metamorphism. Forms basement rock east of Minto Flats north of Tanana River and underlies Clear Creek Butte and hills around Blair Lakes south of Tanana River. A small area of quartz-sericite schist and graphitic schist on upper Totatlanika River and Bonanza Creek at south border of area mapped as Birch Creek Schist, but may be younger. Essential minerals in Birch Creek Schist are quartz, sericite, biotite, plagioclase (commonly albite, some albite-oligoclase), potassium feldspar, graphite, calcite, dolomite, and amphiboles (actinolite and tremolite); accessory minerals include chlorite, garnet, epidote, clinozoisite, hornblende, phlogopite, iron oxides and hydroxides, and rarely staurolite and andalusite. Birch Creek Schist formed by synkinematic metamorphism of shale, siltstone, sandstone, and limestone. Age uncertain but considered to be early Precambrian by Mertie (1937, p. 55) and others. Recent isotopic measurements give dates ranging from 120 m.y. to 1,170 m.y. (Wasserburg, Eberlein, and Lanphere, 1963); on basis of these dates, the age of the Birch Creek Schist is considered to be Precambrian or early Paleozoic. Because of complicated structure and intermixed rock types, the gross thickness of the Birch Creek Schist is unknown, but must be many thousands of feet (Mertie, 1937, p. 73). At least two stages of deformation and recrystallization are indicated, the first probably of higher metamorphic grade than the second. Metamorphic grade is middle (biotite and garnet zones) near Fairbanks, and decreases northwestward to lower (chlorite zone). Well-developed zones of contact metamorphism border intrusive bodies. Earliest folds appear to have northwesterly trend, but later structural trends northeasterly (Forbes and Brown, 1961), parallel to trends of younger rocks in Livengood quadrangle to north. Mineralogic layering and planar parallelism of platy minerals, as well as rare relict bedding, folded into closely spaced isoclinal folds with amplitudes of tens of feet. Only structure mappable on a regional scale is strain-slip cleavage parallel to axial planes of minor folds.

INTRUSIVE IGNEOUS ROCKS

Mzi *Intrusive rocks.*—Dikes and stocks of granite, granodiorite, dacite, and granite porphyry, intruded into schist formations of the Yukon-Tanana upland and the Alaska Range. Unconformably overlain in the Alaska Range by the coal-bearing formation. Age probably Mesozoic, although some may be early Tertiary. Intrusive mass east of Fox is gray to yellowish-brown coarse porphyritic biotite granite or quartz monzonite with microcline phenocrysts. Intrusion northeast of Fort Wainwright (Ladd Air Force Base) is spheroidally weathering medium-grained hypidiomorphic pyroxene-bearing granodiorite, gray where fresh and brown on weathered surfaces. Dikes north and west of Fairbanks are gray to yellowish-brown medium-grained quartz-bearing porphyritic granitic rocks. Dikes near Liberty Bell Mine in Alaska Range are granite porphyry (Overbeck, 1918, p. 355). Intrusion west of Totatlanika River at south edge of map area is gray porphyritic dacite, intruded at shallow depth, with phenocrysts of beta-quartz, calcic andesine, biotite, and hornblende 0.5–3 mm across in a groundmass averaging 0.01–0.1 mm of quartz, andesine, orthoclase, and chlorite. This body has closely spaced nearly vertical joints.

Omu *Mafic and ultramafic rocks.*—Ophitic diorite and serpentinized peridotite make up Wood River Buttes. Diorite contains 45 percent strongly zoned plagioclase laths 1 to 3 mm long and 0.2 to 1 mm thick, with slightly sericitized cores of sodic labradorite (An_{58}) and rims of sodic andesine (An_{44}), 5 to 20 percent pigeonitic augite, and 30 to 40 percent amphibole with variable pleochroism, either pale green to colorless or deep brown to pale yellow. Most augite occurs as cores in amphibole crystals. Mafic minerals locally altered to chlorite(?). Ore minerals constitute about 5 percent of the diorite.

Serpentinized rocks consist of masses of bastite, antigorite, and chrysotile that make up 30 to 80 percent of the rock surrounding relict grains of olivine, bronzite, and, locally, edenite (iron-free hornblende). Picotite is rarely present. Wood River Buttes are on projection of belt of mafic and ultramafic rocks between Chena and Salcha Rivers in Big Delta quadrangle to east, mapped by Mertie (1937, p. 203–205), to which he assigned a Devonian age. An intense linear positive magnetic anomaly extends across the alluviated plain between Wood River Buttes and belt of mafic and ultramafic rocks to northeast, indicating that they are parts of a single belt (Andreasen, Wahrhaftig, and Zeitz, 1964).

EXTRUSIVE IGNEOUS ROCKS

Tb *Basalt.*—Dark-gray and black or brownish olivine basalt, closely jointed and deeply weathered, with local pillow or columnar structure; palagonite present in pillow lavas. On lower slopes of hills in the vicinity of Fort Wainwright (Ladd Air Force Base).

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