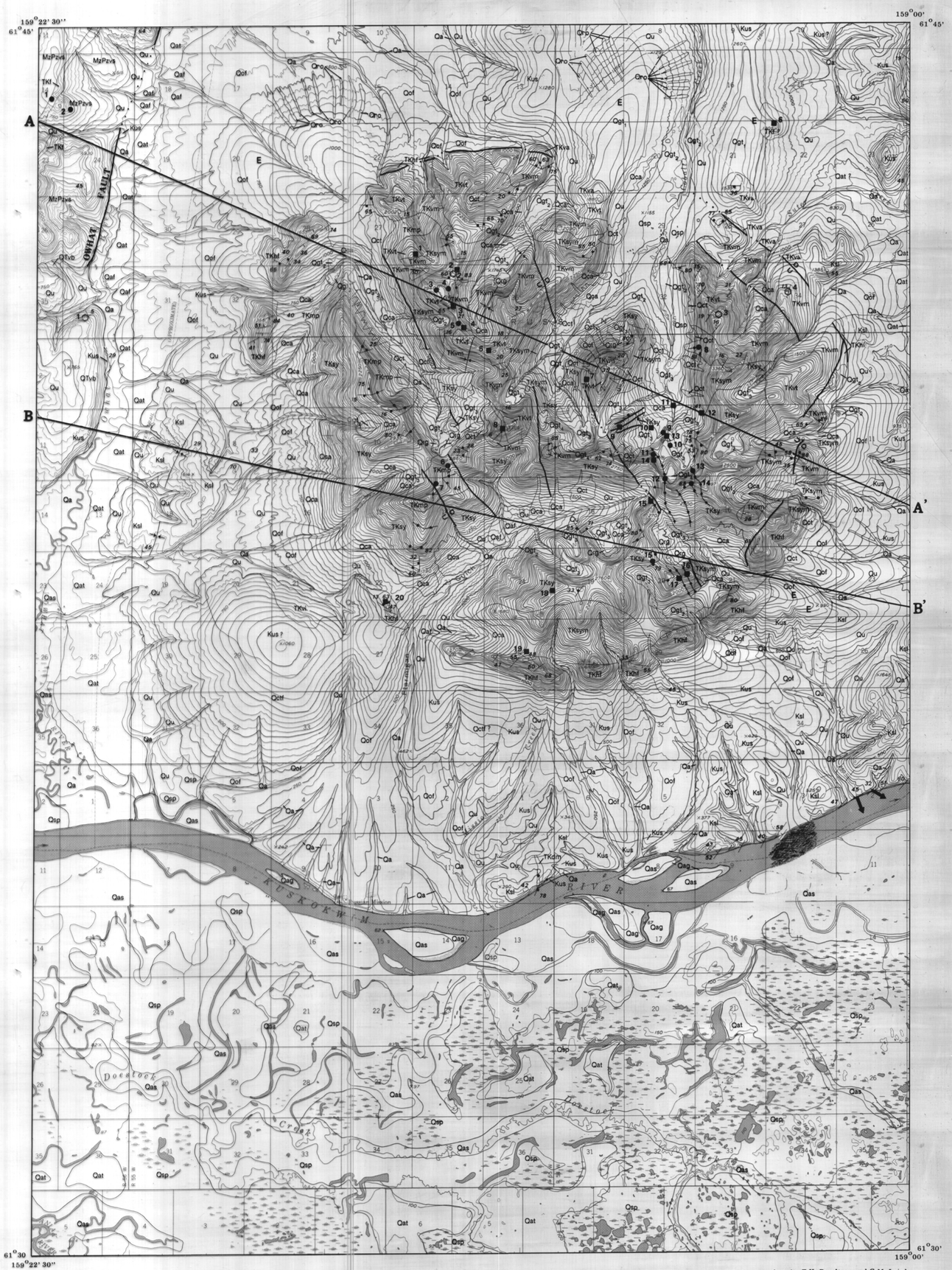


Base from U.S. Geological Survey, 1952.
Universal Transverse Mercator projection, 1927.

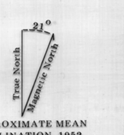
SCALE 1: 63,360

1 ½ 0 1 2 3 4 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

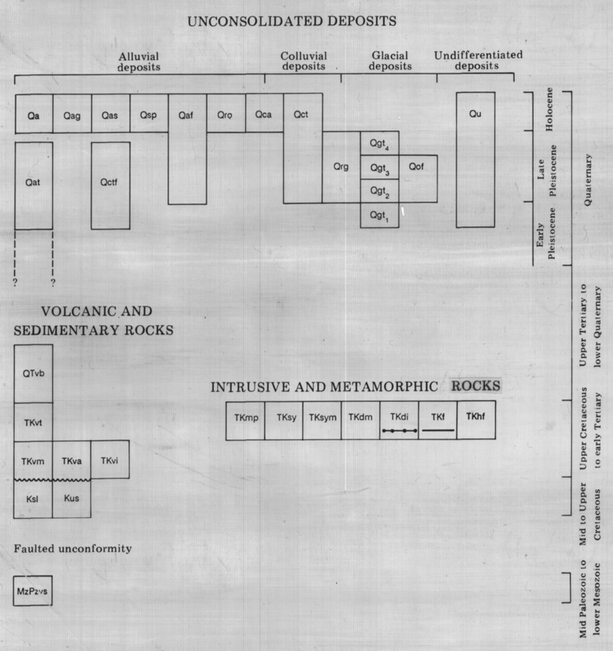
Bedrock geology by T.K. Bundtzen and G.M. Laird, July 18-20, 1985 and June 16-27, 1988; Quaternary geology by T.K. Bundtzen. Technical review by M.S. Robinson and J.T. Kline. Cartography by E.E. Harris.



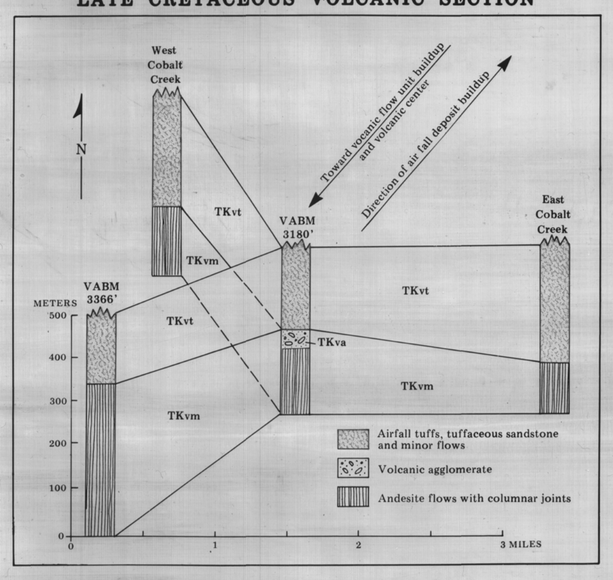
APPROXIMATE MEAN DECLINATION, 1952.

QUADRANLE LOCATION

CORRELATION OF MAP UNITS



FENCE DIAGRAM OF LATE CRETACEOUS VOLCANIC SECTION



MAP SYMBOLS

- Contact - Approximately located
- Bedding, from aerial photographs
- U/D High Angle Fault - Approximately located; dotted where covered. U, upthrown side; D, downthrown side. Arrows show direction of relative movement.
- Anticline, Showing trace of axial plane
- Strike and dip of beds
  - 30 Inclined
  - Vertical
  - Uncertain
- Strike and dip of joints
  - 30 Inclined
  - Vertical
  - Horizontal
- Strike of vertical cleavage
- Bearing of paleocurrent
- E Erratic locality
- 5 Geochemical sample locality at prospect site or mineral occurrence (table 3; plate 2)
- 6 Major-oxide sample locality (table 2; plate 2)
- 3 K-Ar age-date locality (table 1; plate 2)

DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qa SANDY FLOODPLAIN ALLUVIUM - Unconsolidated, well stratified, gray to tan weathered, fine grained sand, silty sand, and silt deposited by modern streams in mature valleys; locally covered by sphagnum moss, and extensive thickets of willow (*Salix* sp.), alder (*Alnus* sp.), and cottonwood (*Populus balsamifera*). Generally thawed.

Qag COARSE GRAINED, GRAVEL RICH ALLUVIUM - Unconsolidated moderate to well stratified, silt, sand, and gravel deposited by modern streams in both glaciated and nonglaciated terrain. Gravel rich deposits in glaciated streams consist of subangular to rounded cobbles and boulders up to 0.5 m in diameter exclusively composed of igneous lithologies. Qag deposited in nonglaciated areas and along Kuskokwim River composed of mixed igneous and sedimentary rock clasts from local source areas; usually confined to point bars of present and past channels along river floodplain. Only deposits proximal to active channels are shown on plate 1. Qag generally thawed except where covered by frozen peat and silt.

Qas FLOODPLAIN ALLUVIUM WITH EXTENSIVE OVERBANK DEPOSITS - Interbedded, dark brownish gray, organic rich sand and silt 1 to 10 m thick that overlie and mask sand floodplain alluvium (Qa) or coarse grained gravel rich alluvium (Qag). Qas deposits show distinctive vertical accretionary layering in cross section consisting of rhythmic layers of silt and sandy silt overlain by a vegetation matte which is in turn overlain by more silt during repetitive flood cycles. Qas forms the high, flat interchannel areas of the flood plains of the Kuskokwim and lower Owhat Rivers. Mostly thawed but some permafrost present in discontinuous zones.

Qsp SILT AND PEAT - Poorly stratified, black to brown, organic rich, alluvial, lacustrine, or bog silt. On Cobalt Creek and southwest of Chuathbaluk contains well stratified peat lines 2 cm to 2 m thick with lenses of ice in mound-like palsas. Bog silt generally mantled with tussocks, grasses, sphagnum, and minor (*Cladonia* sp.) Frequently frozen.

Qat TERRACE ALLUVIUM - Well sorted, moderately stratified, gravel sand, and silt locally cemented by iron oxides; probably includes stripped strath terraces. Surfaces are covered by heavy forest cover in northeastern and southern portions of map area and sphagnum and tussocks in western part near Owhat River. Deposits south of Kuskokwim River mantled with eolian silt. Permafrost present in deposits on Owhat River.

Qaf ALLUVIAL FAN DEPOSITS - Generally poorly sorted, partially stratified sand and coarse gravel deposited in fan-like or cone shaped landforms on secondary streams where they intersect trunk drainages. Permafrost locally present.

Qctf FAN AND TERRACE DEPOSITS - Composite unit containing poorly sorted, partially stratified silt, sand and gravel that form alluvial-colluvial fans, moderately sorted sand and gravel in terrace alluvium, and alluvial aprons near stream cuts. May have formed by erosion of pediment adjacent to Russian Mountains upland. Estimated to be 20 m thick near Mission Creek. Permafrost locally present.

Qro REWORKED GLACIAL OUTWASH AND TILL DEPOSITS - Moderately well stratified, well sorted, sand and pebble gravel reworked from coarser outwash gravels and coarse diamicton. Generally discontinuous in length and covered by pioneer flora; mainly willow (*Salix* sp.) and alder (*Alnus* sp.). Thawed.

Qca COLLUVIAL-ALLUVIAL DEPOSITS - Poorly to moderately well-sorted silt, sand, gravel, and diamicton of alluvial, colluvial, and locally glacial origin. Commonly contain alternating stratified and unstratified zones and lenses in gullies and steep, minor tributary valleys with intermittent or ephemeral streams. Colluvial-alluvial fans generally most active during spring when seasonal snow pack is melting. Generally thawed.

Qct ROCK TALUS - Angular debris derived from frost riving of bedrock followed by gravity transport down slope. Some debris is present more-or-less in place above bedrock sources. Distal zones of talus cones and aprons may grade into inactive rock glaciers. Generally thawed.

Qrg ROCK GLACIER DEPOSITS - Unsorted angular frost-shattered boulders and cobbles. Contained considerable interstitial ice (up to 55 percent) while active; all Qrg deposits in study area are considered inactive. Rock glaciers in Russian Mountain considered tongue shaped morphological type and occur at 600 to 680 m (2,000 to 2,240 ft) elevation in cirque headwalls. Thawed.

Qgt_{1-4} TILL - Unsorted to poorly sorted clay, silt, pebbles, cobbles, and boulder deposited by glacial ice. Qgt till is exposed in various glacial landforms that vary in appearance due to erosional characteristics. Four distinctive subunits correspond to glacial stratigraphy summarized in the Kuskokwim Mountains by Bundtzen (1981) and Kline and Bundtzen (1986). Qgt_1 - Pre-Wisconsin Beaver Creek Glaciation till consisting of highly dissected and reworked till; Qgt_2 - till of Early Wisconsin Bifurcation Creek age consisting of dissected moraines and other modified glacial landforms; Qgt_3 - Late Wisconsin till of Tolstoi Lake age consisting of fresh undissected ground moraine; and Qgt_4 - Early Holocene(?) Crater Mountain glaciation composed of largely unmodified till confined to northerly protected cirques. Permafrost locally present.

Qof OUTWASH FAN DEPOSITS - Moderately well stratified, poorly consolidated, sand and gravel deposited in large, fan shaped landforms proximal to ice marginal meltwater streams in Wisconsin (Late Pleistocene) time. Thickness roughly estimated to be 6 to 40 m thick; may include eroded patches of pre-Wisconsin till.

Qu QUATERNARY DEPOSITS UNDIFFERENTIATED - Unconsolidated alluvial, colluvial, and eolian deposits, including bedrock derived talus and alluvial aprons on moderate to steep hillsides; eolian deposits locally ice rich in valley fill. Thickness highly variable but may reach 70 m in valley floors. Contacts with other units obscured by vegetation. Permafrost frequently present.

INTRUSIVE AND METAMORPHIC ROCKS

TKmp PORPHYRITIC QUARTZ MONZONITE - Light gray to bleached, fine grained to porphyro-aphanitic, clinopyroxene bearing, biotite rich quartz monzonite. Biotite occurs as separate grains and as inclusions in clinopyroxene. Feldspars locally display, classic rapakivi textures. Most thin sections examined show extensive chloritization and epidotization of the groundmass. Axinite locally present in the groundmass.

TKsy QUARTZ SYENITE - Medium gray, medium grained equigranular, biotite rich quartz syenite. Many thin sections show abundant to trace axinite. Clinopyroxene where present exists in trace or minor amounts. Hatched areas indicate zones of ankerite-sericite alteration.

TKsym SYENO-QUARTZ MONZONITE - Medium gray when fresh, subporphyritic, biotite, pyroxene syeno-quartz monzonite transitional in composition between TKsy and TKmp. Zones of ankeritic alteration up to 100 m wide ubiquitous near mineralized veins; purple to colorless axinite clots averaging 1 cm across found near Mission Creek and Headwall gold-arsenic-copper prospects.

Tkf, TKdi, TKdm DIKES AND SMALL HYBABYSSAL INTRUSIONS - Fine grained to porphyro-aphanitic dikes and small shallow intrusions of variable composition. Tkf - fine grained, locally porphyro-aphanitic, K-spar-biotite quartz porphyry dikes; TKdi - medium greenish gray, very fine grained to porphyro-aphanitic, biotite, axinite granodiorite porphyry; axinite locally well developed in TKdi. TKdm - Olivine rich, fine grained phaneritic, gabbro to picrite with distinctive columnar joints. All dike sets intrude along joints in intrusive hosts or along faults in layered rocks.

TKhf HORNFELS - Brown to gray, massive to locally porphyroblastic, chlorite-biotite hornfels locally impregnated with tourmaline. Dark gray varieties difficult to distinguish from aphanitic mafic volcanic rocks (TKvm unit). Volcanic units overlying Russian Mountain pluton are also thermally altered by intrusive, but not shown on plate 1 as hornfels.

VOLCANIC AND SEDIMENTARY ROCKS

QTvb BASALT - Medium to dark gray, olivine clinopyroxene vesicular basalt; locally basaltic andesite. Vesicules locally infilled with calcite and silica. QTvb is essentially unaltered and markedly contrasts with altered TKvi, TKvm, and TKvt volcanic units.

TKvt ANDESITE TO DACITE FLOWS AND TUFF - Medium green-gray, very fine grained, porphyritic, biotite andesite to dacite flow, light greenish gray, platey weathered, fine to medium grained crystal lithic tuff, and greenish gray, fine grained, tuffaceous sandstone. Unit caps volcanic stratigraphy in Russian Mountains and forms gradational boundary with underlying TKvm flows. Estimated to be 150 m thick in northeastern portion of study area.

TKvm BASALTIC ANDESITE AND ANDESITE - Medium to dark greenish gray, aphanitic to fine grained, locally porphyritic (with plagioclase), pyroxene rich basaltic andesite and andesite. Series of well developed columnar joints exposed in southcentral Russian Mountains where TKvm flow section are thickest (250 m) thinning to 100 m on Cobalt Creek and 150 m in northwestern Russian Mountains (fig. 1). This generally resistant unit grades into slightly more felsic flows of overlying TKvt unit.

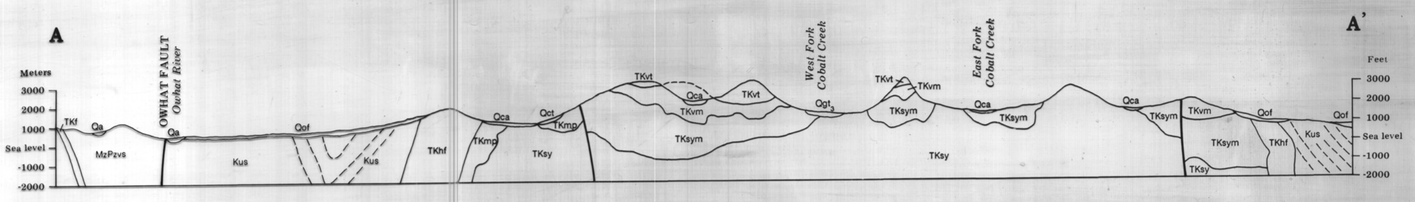
TKva VOLCANIC AGGLOMERATE - Medium to dark greenish gray lapilli tuff and agglomerate containing elliptical bombs and subangular to rounded fragments of andesite to 150 cm diameter. Thickness of unit is unknown.

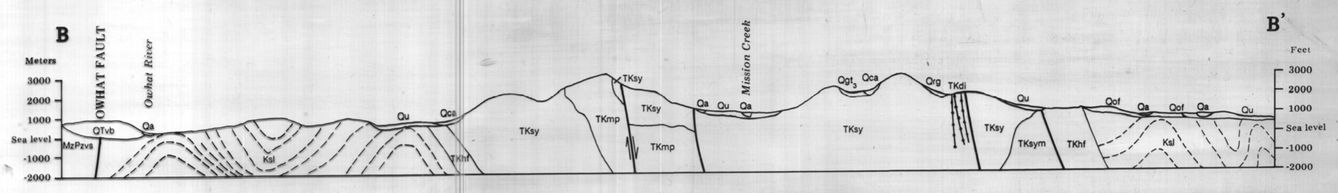
TKvi ANDESITE TO DACITE - Light to medium greenish gray, porphyro-aphanitic pyroxene andesite to dacite flows. Poorly exposed sections southwest of Russian Mountains are of unknown thickness and stratigraphic arrangement with other volcanic units is uncertain.

Kls CALCAREOUS LITHIC SANDSTONE - Gray to locally tan, fine to coarse grained, subangular to rounded, calcareous lithic sandstone and interbedded micaceous siltstone. Exhibits ripup clasts. Bouma T_{a-c} divisions, and scour-and-fill features which suggest deposition by turbidity currents. Locally rich in plant stems. Carbonate content, which is of detrital origin, ranges from 1 to 8 percent of grains in thin section. Equivalent to other Kuskokwim Group limey clastic units mapped elsewhere (Bundtzen and Laird, 1982; Bundtzen and others, 1988). Thickness unknown.

Kus CRETACEOUS SEDIMENTARY ROCKS UNDIFFERENTIATED - Heterogeneous unit of fine to coarse, generally noncalcareous, micaceous sandstone, siltstone, and minor shale. Contains turbidite characteristics of Kls unit. Quaternary and vegetative cover obscures contacts with other rock units. Generally nonresistant. Thickness unknown.

MzPzvs ALTERED MAFIC ROCKS, SANDSTONE, AND ARGILLITE - Poorly exposed heterogeneous section of dark green, fine to coarse grained, altered metabasalt, green, feldspathic, tuffaceous sandstone, dark gray to brown argillite, and undetermined, green porphyritic greenstone. These highly deformed rocks probably equivalent to Gemuk Group (Cady and others, 1955) or volcanic dominated rock section of Nyac Terrane (Box, 198).





No vertical exaggeration in cross sections

GEOLOGIC MAP OF THE RUSSIAN MISSION C-1 QUADRANGLE, ALASKA

By

T.K. Bundtzen and G.M. Laird

1989