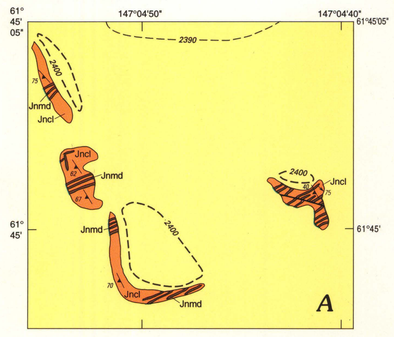
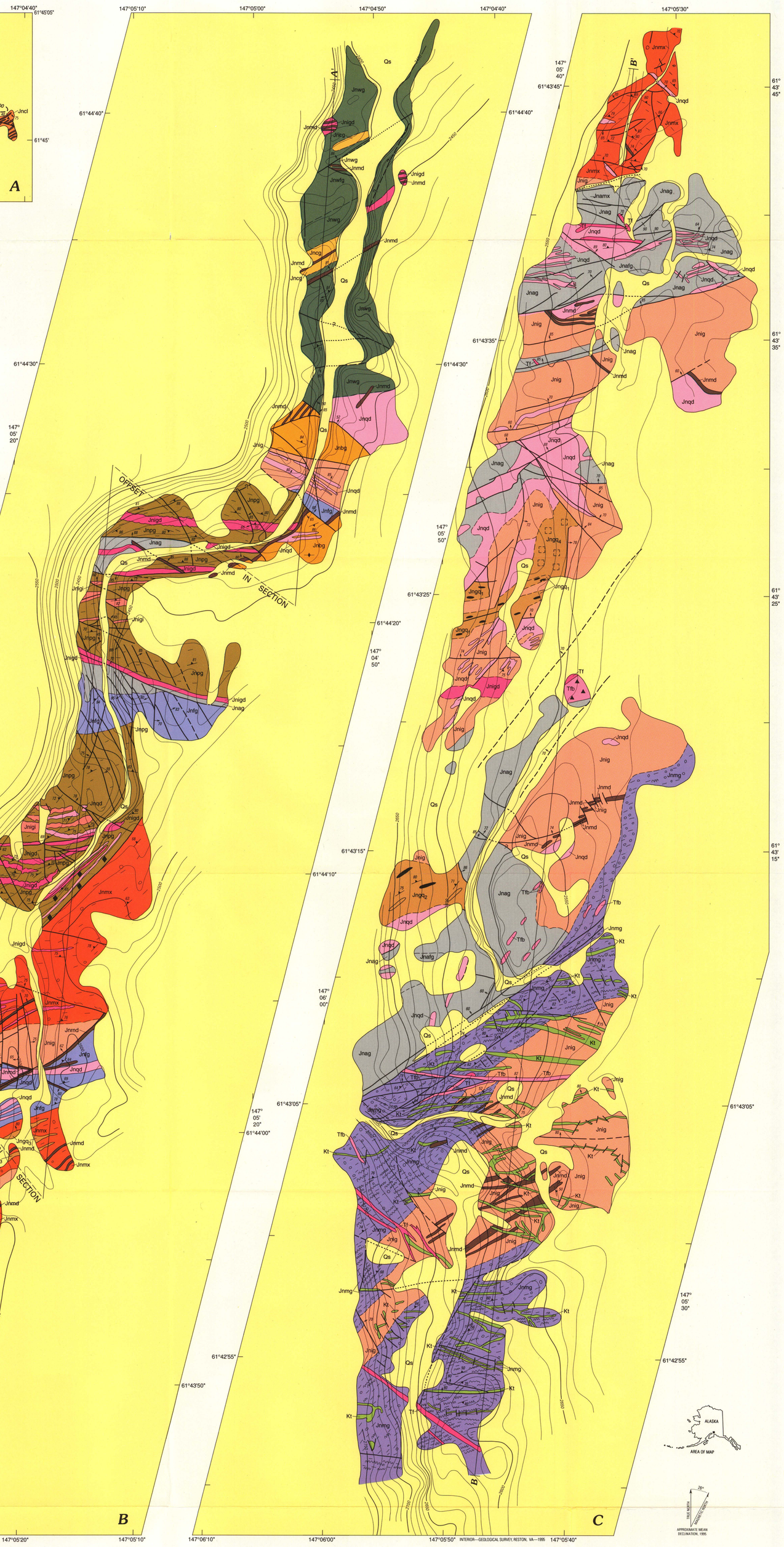
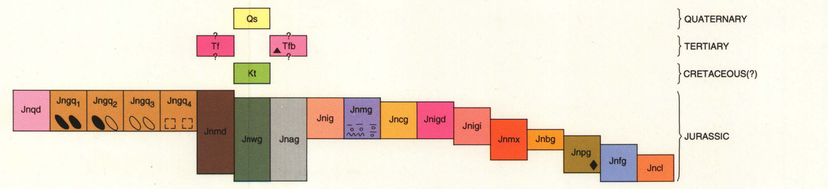
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BULLETIN 2058
PLATE 1





CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

[All map patterns with elongation—such as dashes, ovals, and wavy lines—are oriented in the direction of inclusions, igneous foliation, or layers]

Qs **Surficial deposits (Quaternary)**—Glacial and alluvial deposits

Tf **Felsite dikes and plugs (Tertiary)**—Fine-grained, generally orange-weathering, hypabyssal dikes (less than 2 m wide) and small plugs; andesitic to dacitic in composition. Commonly porphyritic, with phenocrysts of plagioclase and subordinate hornblende and (or) quartz. Dikes are strongly altered to chlorite-dominant assemblages with minor calcite

Tfb **Felsite intrusive breccia and dikes (Tertiary)**—Brown-weathering narrow dikes and irregular masses. Contains angular to subrounded clasts of country rock (quartz diorite, gabbronorite, vein quartz) and clasts of felsite in felsitic matrix. Solid triangle indicates dominantly gabbroic clasts without much intervening felsitic matrix

Kt **Trondhjemite (Cretaceous?)**—Medium-grained (1–2 mm), white-weathering dikes composed of plagioclase (65–75 percent), quartz (25–35), hornblende (less than 10 percent; largely altered to chlorite); minor amounts of white mica and (or) garnet

Nelchina River Gabbronorite (Jurassic)—Consists of:

Jnqd **Quartz diorite and tonalite**—Medium-grained, gray to white, small plutons and dikes composed of plagioclase (40–65 percent), quartz (15–30 percent), and hornblende (10–25 percent) with minor opaque minerals. Unit locally includes more leucocratic rocks with associated alteration (irregular patches of limonite staining and chloritization). Near M1 (see index map), quartz diorite intruded banded gabbronorite (**Jnbg**) within the isotropic gabbronorite unit (**Jnig**) but is too small to depict at this scale

Mixed gabbroic and quartz diorite rocks—Divided into four units on the basis of texture:

$Jngq_1$ **Unit 1**—White-weathering, flow(?)-foliated quartz diorite containing small, lenticular inclusions (about 6 cm long) of gabbronorite and hornblende gabbronorite. Schlieren and folds similar to those found in migmatites are common textural features in these rocks. Gabbroic inclusions are generally fine grained and dark weathering. Most common of four units. Pattern orientation indicates general orientation of inclusions

$Jngq_2$ **Unit 2**—Mixture of gabbroic and quartz diorite rocks that resemble thinly banded gneisses and contain plagioclase crystals with albitic rims visibly in hand specimen. Pattern orientation indicates general orientation of inclusions

$Jngq_3$ **Unit 3**—Quartz diorite containing abundant ovoid inclusions (4–15 cm) of gabbronorite and hornblende gabbronorite. Inclusions primarily consist of coarse- and fine-grained gabbronorite and locally have rims of coarse hornblende. Pattern orientation indicates general orientation of inclusions

$Jngq_4$ **Unit 4**—Large blocks (0.6 m) of generally medium-grained gabbronorite or hornblende gabbronorite in a matrix of quartz diorite

Jnmd **Mafic dikes**—Fine- to medium-grained (0.1–0.25 mm), dark-colored, narrow dikes; includes hornblende gabbros, hornblende gabbronorites, cataclastically deformed hornblendites, and very minor amounts of gabbronorites and pyroxenites

Jnwg **Weathered gabbronorite**—Mixed gabbroic units locally so sheared, fractured, and weathered (to green-brown) that primary textures and field relations cannot be discerned in outcrop or in hand specimen. Petrographic study, however, indicates that weathered gabboronite at north end of Nelchina transect includes some of transect's least altered rock, consisting of fine- to medium-grained gabbronorite, hornblende gabbronorite, and mafic dikes. Where exposures reveal recognizable textures, abundant fine-grained mafic dikes (**Jnmd**) intrude weathered gabbronorite and are parallel to dikes in dike complex to south and to mafic dikes in cumulus-layered gabbronorite section to north. Includes large mass of fine-grained, weathered gabbronorite (**Jnwfg**)

Jnag **Pervasively altered gabbroic rocks**—Many outcrops of gabbroic units of Nelchina River Gabbronorite show extensive deformation, low-temperature alteration, quartz veining, and weathering, which obscure primary textures and mineralogy in hand specimen. Rocks in this unit probably consisted originally of fine- to medium-grained gabbronorite and hornblende gabbronorite, containing minor amounts of primary magnetite and ilmenite but may have included diorite. Largely composed of primary hornblende, secondary clinozoisite, epidote, chlorite, fibrous amphibole, and minor amounts of quartz±albite. Near M3 (see index map), unit contains abundant quartz diorite. Locally includes zones as much as 2 m wide of less deformed rocks exhibiting primary textures: Fine-grained gabbronorite (**Jnafg**) and mixed gabbroic rocks (**Jnamx**)

Jnig **Isotropic gabbronorite**—Medium-grained (2–5 mm), nonlayered gabbronorite and hornblende gabbronorite. Originally composed dominantly of plagioclase, orthopyroxene, clinopyroxene, and hornblende but now largely altered to clinozoisite, chlorite, epidote, and fibrous amphiboles

Jnmg **Metasedimentary, metavolcanic, and gabbroic rocks**—Metasedimentary and metavolcanic rocks, which have been intruded by gabbronorite. Protolith age for metamorphic rocks may be as old as late Paleozoic. Locally three lithologic subgroups are distinguishable: (1) calc-silicate marble, as lenses as much as 1.5 m wide and 85 m long (shown as wavy lines, scale exaggerated, location approximate; bent wavy lines delineate large fold in metamorphic rocks), (2) lit-par-lit-textured metamorphic rocks (dashes), and (3) gabbroic rocks (circles). Lit-par-lit-textured metamorphic rocks and gabbroic rocks are shown schematically but in approximate proportions for given location

Jncg **Coarse-grained gabbronorite**—Composed of coarse (5–7 mm) plagioclase, clinopyroxene (3.5 mm), orthopyroxene (3.5 mm), and minor amounts of intercumulus tan hornblende; two limited occurrences, north end of transect

Jnigd **Isotropic gabbronorite dikes and hornblende gabbronorite dikes**—Gray to white, medium-grained (2–5 mm), 3- to 5-m-thick dikes. Composed of plagioclase (70–85 percent), orthopyroxene (5–15 per-cent), clinopyroxene (5–15 percent), primary hornblende (0–10 percent), and magnetite+ilmenite (0–4 percent). Commonly altered to clinozoisite, chlorite, epidote, and fibrous amphiboles. Near M2 (see index map), some dikes probably are composed of quartz diorite. Isotropic gabbronorite, probably emplaced as dikes, but locally contacts are poorly exposed

Jnigi **Isotropic gabbronorite dikes with inclusions of foliated gabbroic rocks**—Gray-weathering, fine- to medium grained (1–3 mm) dikes of gabbronorite with lesser hornblende gabbronorite containing abundant, large sheetlike inclusions of podiform hornblende gabbronorite (**Jnpg**). In mineralogy and alteration assemblage, dikes are similar to those of isotropic gabbronorite dikes and hornblende gabbronorite dikes unit (**Jnigd**)

Jnmx **Mixed gabbroic rocks**—Fine-grained, dark-weathering gabbronorite and hornblende gabbronorite intruded by coarser grained gabbronorite or diorite. Variable grain size, lenticular inclusions (2–6 cm long) of fine-grained gabbronorite within coarser grained gabbronorite, and diffuse dike margins are characteristics of this unit

Jnbg **Banded gabbronorite**—Fine-grained (0.1–0.25 mm), dark-weathering gabbronorite, with or without hornblende, intruded by 2- to 3-cm-wide, subparallel dikes of medium-grained (0.5–1.0 mm), gray-weathering gabbronorite. Primary minerals for both medium- and fine-grained varieties include plagioclase (40–50 percent), orthopyroxene (10–25 percent), clinopyroxene (10–25 percent), hornblende (5–25 percent), and magnetite+ilmenite (4–12 percent). Commonly altered to clinozoisite, epidote, chlorite, and fibrous amphiboles

Jnpg **Podiform hornblende gabbronorite**—Green-weathering, fine-grained hornblende gabbronorite (0.1–2.5 mm), with lesser gabbronorite; characterized by thin pods or layers of coarse crystals, primarily hornblende, with lesser magnetite, ilmenite, and plagioclase. Hornblende gabbronorite originally composed of pale-greenish-tan magnesiohornblende (10–35 percent), plagioclase (40–60 percent), orthopyroxene+clinopyroxene (10–30 percent), magnetite+ilmenite (5–15 percent), and apatite (0–2 percent). Characteristically altered to chlorite, epidote, clinozoisite, and minor fibrous amphiboles. Locally includes small (3 cm) xenoliths of ultramafic rocks (♦)

Jnfg **Fine-grained gabbronorite and hornblende gabbronorite**—Dark-weathering, fine-grained (0.1–0.25 mm) gabbronorite; typically contains hornblende (5–20 percent) and magnetite+ilmenite (2–10 percent)

Jncl **Cumulus-layered gabbronorite**—Medium-grained, rusty-weathering, layered gabbronorite; composed of plagioclase (40–70 percent), orthopyroxene (15–30 percent), clinopyroxene (15–30 percent), and pale-greenish-tan hornblende (3–20 percent). Characterized by modally graded layers 1 cm to 5 m wide

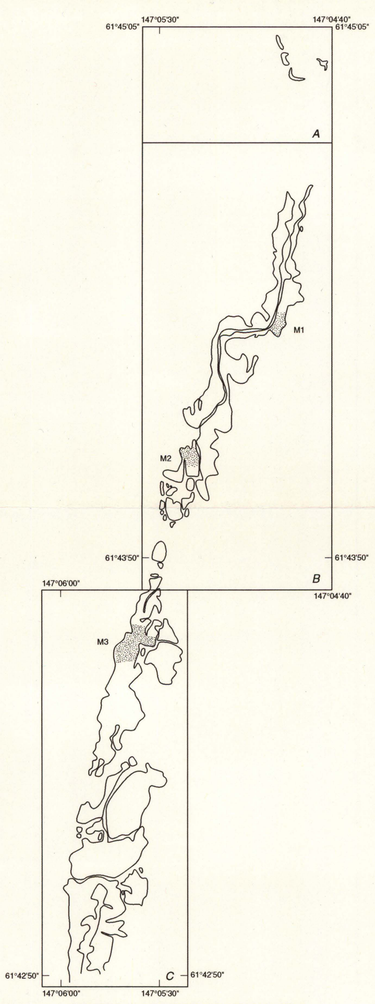
Contact—Dashed where gradational; queried where doubtful or poorly exposed

Fault—Showing dip. Dotted where concealed; dashed where approximately located; queried where doubtful

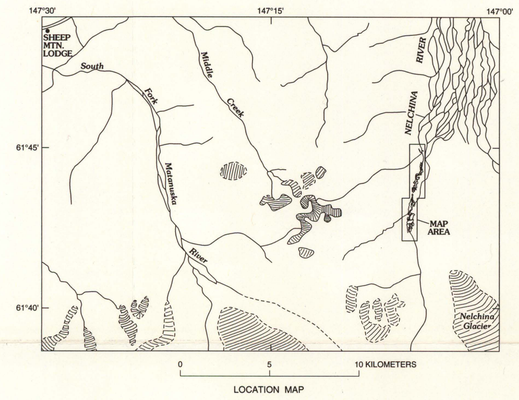
Shear zone

Strike and dip of dike

Strike and dip of igneous and metamorphic foliation
Inclined
Vertical



INDEX MAP NOTING AREAS DISCUSSED IN TEXT



LOCATION MAP

Topographic base for area south of 61°44'45" N. planetabled by G.H. Pessel; assisted by J. C. Pessel and K.S. Emmel, 1981: base for area north of 61°44'45" derived from U.S. Geological Survey 1:63,360 Anchorage C-1 and D-1 quadrangles, 1960, using photointerpretation, 1990

Geology mapped in 1981

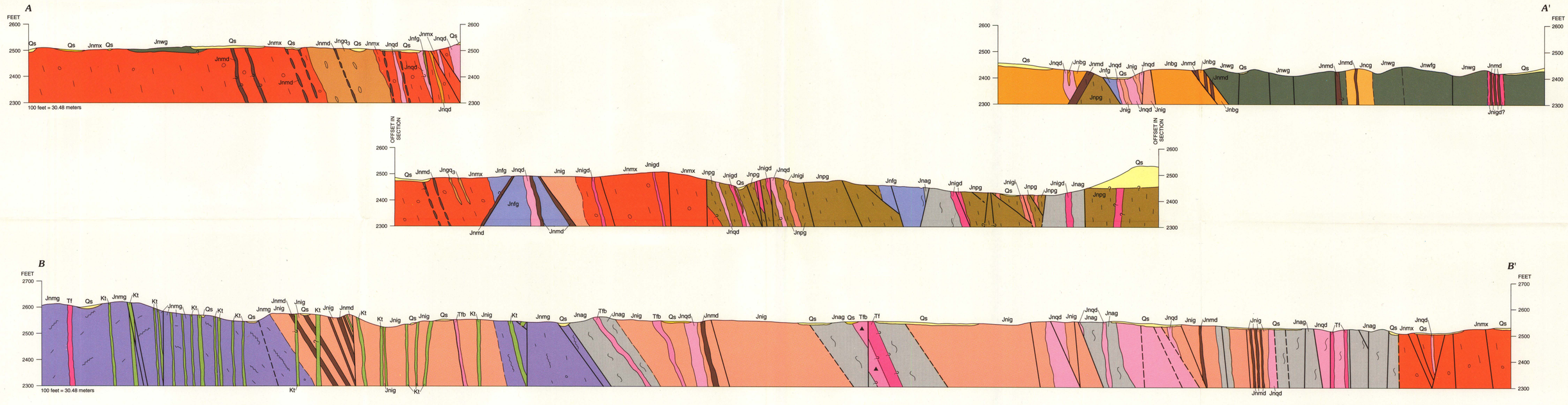
SCALE 1:2,400

100 0 100 200 300 400 500 600 700 FEET
50 0 50 100 150 METERS

CONTOUR INTERVAL 10 FEET
DASHED WHERE APPROXIMATE
NATIONAL GEODETIC VERTICAL DATUM OF 1929

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1995

Geology mapped in 1981



BEDROCK GEOLOGY OF PART OF THE NELCHINA RIVER GABBRONORITE, SOUTH-CENTRAL ALASKA

By
Laurel E. Burns

1995

Burns, Laurel E., 1995, Geology of part of the Nelchina River Gabbronorite and associated rocks, south-central Alaska: U.S. Geological Survey Bulletin 2058