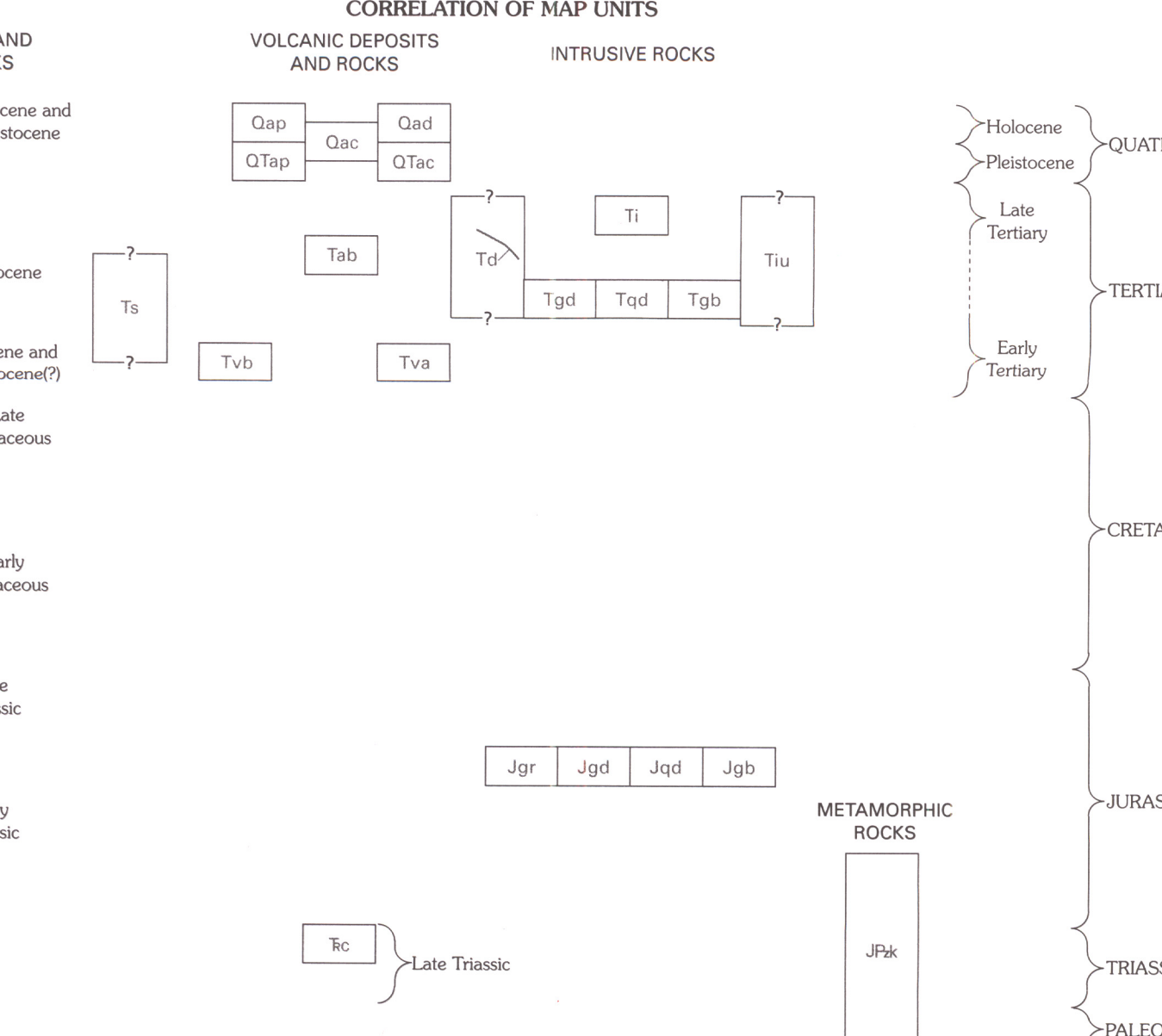


Base from U.S. Geological Survey
Mt. Katmai, 1962 (revised 1975);
Afoqnak, 1952 (revised 1962);
Naknek, 1952 (revised 1988);
Universal Transverse Mercator Projection

EXPLANATION
PORPHYRY-COPPER SUITE

Sample did not contain anomalous concentrations of elements in the porphyry-copper suite
Sample from outcrop
Sample from stream float
Drainage basin containing anomalous concentrations of Cu and Mo; Sn or W as determined in both stream sediments and nonmagnetic-heavy-mineral concentrates
Drainage basin containing anomalous concentrations of elements in the base-metal polymetallo-vein suite as determined in both stream sediments and nonmagnetic-heavy-mineral concentrates
Drainage basin containing more than 25 percent sulfide minerals in the nonmagnetic-heavy-mineral separate from panned concentrates
Scheelite observed in panned concentrates

Rock sample locality
Sample contained anomalous concentrations of elements in the porphyry-copper suite at the 95th or 98th percentile (see star diagram above)—Numbered localities correspond to entries in tables 11-18
Sample from outcrop
Sample from stream float



DESCRIPTION OF MAP UNITS
SURFICIAL DEPOSITS AND SEDIMENTARY ROCKS
Qs Surficial deposits (Holocene and Pleistocene)—Unconsolidated to poorly consolidated alluvial, colluvial, glacial, marine, lacustrine, and eolian deposits. Locally includes extensive redeposited pumice and ash from the Novorupta eruption.
Qs1 Landslide deposits (Holocene and Pleistocene)—Nonsorted, nonstratified, coarse, angular rubble forming lobate masses.
Ts Sedimentary rocks (Tertiary)—Poorly to moderately well indurated fluvial sandstone, siltstone, tuff, and conglomerate; larger clasts consist of locally derived plutonic and volcanic rocks.
Th Hemlock Conglomerate (Pleistocene)—Poorly indurated fluvial conglomerate, pale-brown tuffaceous sandstone, siltstone, shale, coal, and tuff. Age is late Oligocene.
Tc Copper Lake Formation (Eocene and Paleocene?)—Well-indurated polymictic conglomerate, sandstone, and siltstone.
Kk Kaguyak Formation (Late Cretaceous)—Upper part consists of interbedded siltstone and graded graywacke sandstone that represent the upper and middle regimes of a submarine fan. Lower part consists of thinly bedded siltstone and shale that contain ammonites of Albian age.
Kp Pedmar Formation (Early Cretaceous)—Thick-bedded, gray sandstone and minor amounts of siltstone and shale that contain ammonites of Albian age.
Kh Heredeen Formation (Early Cretaceous)—Calcareous sandstone and interbedded siltstone; thinly bedded, light to dark olive gray.
Ka Stanikovich Formation (Early Cretaceous)—Siltstone, shale, and thinly bedded, fine-grained, brown feldspathic sandstone.
Jn Naknek Formation (Late Jurassic)—Main sedimentary rock unit of the map area, consisting of sandstone, conglomerate, and siltstone; massive to thin-bedded, brown to dark olive gray. Divided into five members (not mapped separately here), from oldest to youngest: massive nonmarine conglomerate and thinly bedded sandstone member; thick-bedded to massive sandstone member; thinly bedded, dark-gray marine siltstone member containing limestone concretions; thinly bedded marine sandstone and siltstone member; massive conglomerate member. Conglomerate in both the oldest and youngest members are metamorphic, volcanic, and sedimentary rocks with subordinate plutonic rocks.
Jr Talkeena Formation (Early Jurassic)—Lava flows, breccias, and lahars locally interbedded with volcaniclastic sandstone, conglomerate, and shale. Includes sills of uncertain age. Locally metamorphosed to nonschistose epidote-alkali-calcic assemblages suggestive of lower greenschist facies.
Jk Kamishak Formation (Late Triassic)—Slightly recrystallized, nonfossiliferous limestone and interbedded basalt flows and breccia.

VOLCANIC DEPOSITS AND ROCKS
Qap Pyroclastic-flow deposits (Holocene)—Poorly sorted, variably indurated deposits of ash, vitrophylic blocks, and (or) pumiceous lapilli of the 1912 ash flow of Novorupta and the Holocene block-and-ash flows of Kaguyak calderas.
Qad Domes (Holocene)—Domes of dacitic or rhyolitic composition.
Qac Younger central-vent deposits and rocks (Holocene and Pleistocene)—Lava flows, tuffs, and breccias predominantly of andesitic composition but locally including lava flows of low-silica dacitic composition, airfall deposits of andesitic to rhyolitic composition on Baker Mountain and Broken Mountain, and scoria cones of basaltic composition.
QTap Pyroclastic-flow deposits (Pleistocene and late Tertiary)—Poorly sorted, variably indurated deposits of ash, vitrophylic blocks, and (or) pumiceous lapilli. Primary compositions are uncertain because of alteration but probably range from andesitic to dacitic.
QTac Older central-vent deposits and rocks (Pleistocene and late Tertiary)—Lava flows, breccias, and domes of andesitic and dacitic composition. Locally moderately to extensively altered where associated with local fumaroles (bleaching to light-red or yellow shades).
Tab Volcanic rocks of Barrier Range (late Tertiary)—Breccias, lava flows, sills, and local pyroclastic andesitic tuffs of late Tertiary volcanic field located southeast of the Aleutian Range crest and extending from the Katmai River to Kukla Bay. Predominantly of andesitic and dacitic composition. Propylitic alteration is extensive and argillite or potassic alteration is locally intensive, such as near contacts with hypabyssal intrusive rocks (Ti).
Tvb Volcanic rocks north of Naknek Lake.
Tva Basaltic lava (early Tertiary)—Plugs, dikes, and flows of basaltic composition that intrude or overlie andesitic and dacitic lava flows and breccia (Tva).
Tvc Andesitic and dacitic lava flows and breccia (early Tertiary)—Unit also includes local domes or tuffs of rhyolitic(?) composition, now altered to quartz and sericite or kaolinite.
Tc Cottonwood Bay Greenstone (Late Triassic)—Slightly metamorphosed basalt, locally intruding fine- to medium-grained diabase sills(?).
Td Dikes (Tertiary)—Dikes from 1 to 20 m wide that occur mainly southeast of the Bruni Bay fault and have a northwest trend. Many are

in rocks as young as the Hemlock Conglomerate (Th), suggesting that most dikes are middle to late Tertiary in age.
Ti Hypabyssal intrusive rocks near Shelkol Strait (late Tertiary)—Sill-like or cross-cutting subvolcanic intrusive bodies generally less than 10 km² in outcrop area, as well as larger plutonic bodies such as those beneath Fourpeaked Volcano or along the Aleutian Range crest east of Serpent Tongue Glacier. Fine-grained, porphyritic to equigranular rocks that consist predominantly of granodiorite or tonalite and minor quartz diorite.
Ttu Hypabyssal intrusive rocks, undivided (Tertiary)—Intrusive bodies ranging from small plugs and sills to plutons exposed over as much as 30 km². Rocks are fine to medium grained, are commonly porphyritic, and consist chiefly of quartz diorite or tonalite.
Tgd Granodiorite (middle Tertiary)—Medium-grained equigranular to marginally porphyritic rocks in which modal quartz rarely exceeds 25 percent; unit includes rocks that are mineralogically classified as quartz monzonite or quartz diorite.
Tod Quartz diorite (middle Tertiary)—Medium-grained equigranular rocks in which accessory hornblende exceeds biotite; also occurs as zones within intrusions of granodiorite (Tgd).
Tgb Gabbro and diorite (middle Tertiary)—Medium-grained rocks having gabbroic or diabasic textures.
Jgr Granite (Jurassic)—Medium-grained equigranular or fine-grained porphyritic rocks in which biotite exceeds hornblende.
Jgd Granodiorite (Jurassic)—Medium-grained equigranular or fine-grained porphyritic rocks. Also includes isolated outcrops of tonalite and quartz diorite. Modal quartz is 22-44 percent of rock.
Jqd Quartz diorite and tonalite (Jurassic)—Medium-grained equigranular rocks containing accessory biotite; unit includes some granodiorite.
Jgb Diorite and gabbro (Jurassic)—Dark, diabasic and gabbroic-textured rocks.
Jka METAMORPHIC ROCKS
Kak Kakhonk Complex (Jurassic, Triassic, and Paleocene?)—Locally foliated or banded quartzite, schist, amphibolite, and garnet-bearing gneiss indicative of amphibolite-facies metamorphism. Protoliths presumably consist of Talkeena Formation (Jt), Kamishak Formation (Kk), Cottonwood Bay Greenstone (Tc), and unnamed sandstone and argillite.

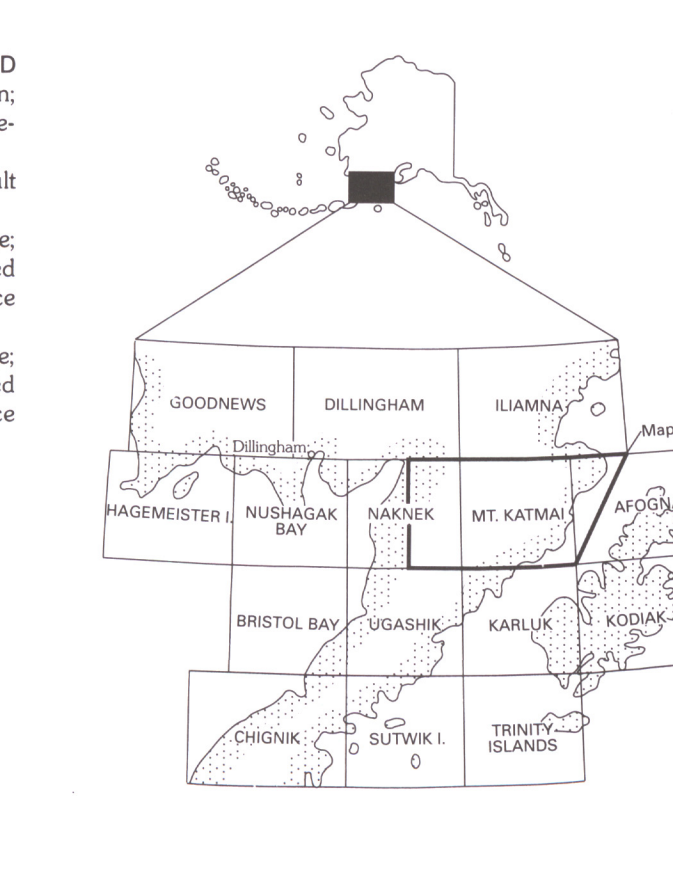
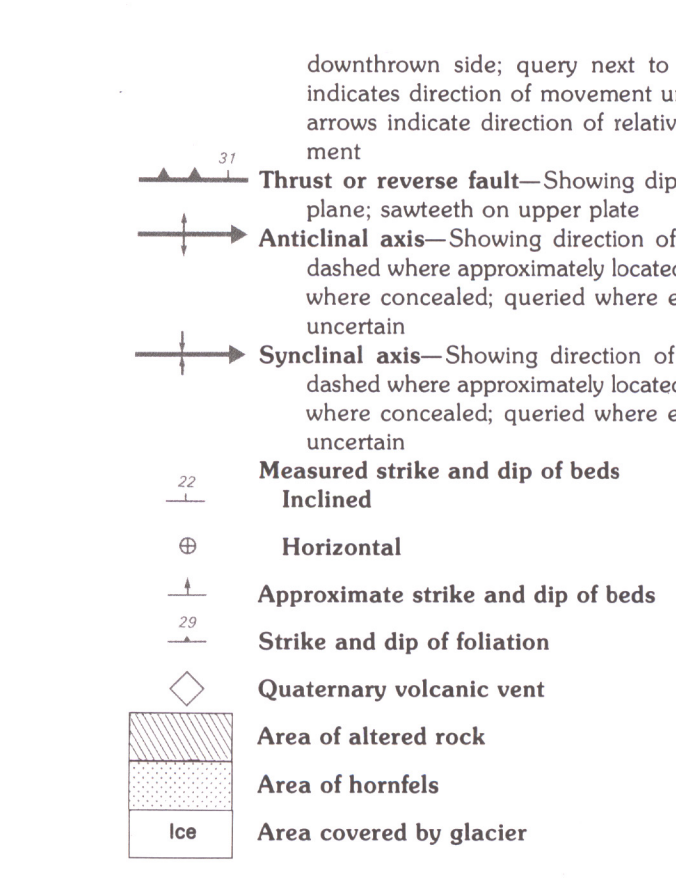


Table 8. Summary of threshold values (95th and 98th percentiles) used for rock and float samples plotted on plate 1, Katmai study area, Alaska. [Analysis by semiquantitative emission spectrometry; all concentrations expressed as parts per million. Threshold values determined largely from the data in tables 1 and 4; < concentration is less than reported value.]

Elem.	Librologic unit ¹															
	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Unit 6		Unit 7		Unit 8	
	95th	98th	95th	98th	95th	98th	95th	98th	95th	98th	95th	98th	95th	98th	95th	98th
Cu	150	200	100	200	100	200	150	500	100	150	150	700	100	150	100	200
Mo	5	7	7	10	7	10	15	7	10	15	25	5	7	10	10	150
Co	100	300	100	500	700	50	100	50	70	100	150	50	70	100	100	200
Ni	70	100	50	70	50	100	50	70	50	70	50	70	50	70	50	100
Cr	300	500	200	300	200	300	150	200	200	300	200	300	150	200	200	300
Sr	10	20	10	10	20	10	10	20	10	20	10	20	10	20	10	20
W	<50	50	<50	50	<50	50	<50	50	<50	50	<50	50	<50	50	<50	50

1. Metamorphosed rocks northwest of Bruni Bay fault (Kakhonk Complex, Cottonwood Bay Greenstone, Kamishak Formation, Talkeena Formation), and, locally, southwest of Bruni Bay fault, hornfelsed rocks adjacent to plutons; 94 samples were analyzed for most elements.
2. Mesozoic sedimentary rocks (Naknek, Stanikovich, Heredeen, Pedmar, and Kaguyak Formations); 357 samples were analyzed for most elements.
3. Tertiary sedimentary rocks (Copper Lake Formation, Hemlock Conglomerate, and undivided Tertiary rocks); 90 samples were analyzed for most elements.
4. Jurassic and Tertiary plutonic rocks of the Aleutian Range (including gabbro, diorite, quartz diorite, tonalite, granodiorite, and granite) and Tertiary hypabyssal plutons and sills occurring throughout the Katmai study area; 86 samples were analyzed for most elements.
5. Tertiary dikes (generally middle to late Tertiary); 28 samples were analyzed for most elements.
6. Tertiary volcanic rocks (informally named "volcanic rocks of Barrier Range" and "volcanic rocks north of Naknek Lake"); 474 samples were analyzed for most elements.
7. Quaternary volcanic rocks (chiefly lava flows and domes at or near the area of the Aleutian Range); 73 samples were analyzed for most elements.
8. Altered rock samples from unspecified formations; threshold values taken from the stream-sediment data set (table 1).

MAP OF THE MOUNT KATMAI QUADRANGLE AND ADJACENT PARTS OF THE AFOGNAK AND NAKNEK QUADRANGLES, ALASKA, SHOWING GEOCHEMICAL DATA INDICATING UNDISCOVERED PORPHYRY-COPPER DEPOSITS

By
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1994