GEOLOGY
OF THE
JUNEAU (B-3) QUADRANGLE, ALASKA
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INTRODUCTION

The Juneau (B-3) quadrangle, at a scale of 1:63,360 (15 minutes of latitude by 20 minutes of longitude), comprises 1/24 of the Juneau quadrangle at a scale of 1:250,000 (1 degree of latitude by 2 degrees of longitude). The northeastern part of the map area lies on the western flank of the Coast Range. Mansfield Peninsula, which is the northernmost part of Admiralty Island, and the smaller islands in the quadrangle are a part of the Alexander Archipelago. Lynn Canal, which extends along much of the western boundary of the quadrangle, and its southward extension Chatham Strait, is part of a 230-mile long fiord.

Most of the Juneau (B-3) quadrangle is heavily timbered with hemlock, spruce, and cedar. Muskeg covers much of Mansfield Peninsula and the ridges east of Peterson Lake on the mainland. The forest floor is heavily carpeted with moss, which effectively conceals much of the underlying rock. Berry bushes, devil's club, and other types of brush form thickets in most of area. Bedrock is well exposed along the beaches, but outcrops are scant to nonexistent inland. Glacial till, which has not been mapped by the author, covers bedrock north of Funter Bay, along upper Bear Creek, and elsewhere in the quadrangle.

Previous geologic work in the quadrangle includes a reconnaissance of Admiralty Island by C. W. Wright (1906), a reconnaissance of the mainland portion by Adolph Knopf (1912), and preliminary detailed mapping by C. L. Sainsbury and W. S. Twenhofel (written communication) of the Geological Survey. Sainsbury mapped Shelter, Lincoln, Hump, and Portland Islands, and parts of eastern Mansfield Peninsula. He discovered the Shelter Island syncline, and determined the general stratigraphic sequence along Saginaw Channel and Stephens Passage. Twenhofel mapped the mainland portion of the quadrangle and 17 of the dip and strike symbols east of Peterson Creek are from his work. He interprets the rocks of the mainland as being stratigraphically right side up and part of a regional monocline.

GEOLOGIC FORMATIONS

The layered rocks of the Juneau (B-3) quadrangle strike from about N. 15° W. to N. 70° W., and dip steeply to the east. The axis of the Shelter Island syncline passes along Shelter Island and Stephens Passage. The Treadwell formation and the Douglas Island volcanic group of the overturned northeastern limb of the syncline, though probably at least equivalent to the Retreat group and the Barlow Cove formation, differ in lithologic characteristics and are given different names. The Symonds and Shelter formations lie on both flanks of the fold, along the axial plane. A large drag fold, the Lone Mountain fold, occurs in the Barlow Cove formation. An elongate mass of quartz diorite has intruded the Retreat group along Lynn Canal. Gabbro underlies much of Lincoln Island. Longitudinal faults, which are roughly parallel to the trend of the rocks, and transverse faults, which strike northeast and dip very steeply, cut both the layered and intrusive rocks.

LAYERED ROCKS

Retreat group.—The interlayered sericite schist, greenschist, slate, graywacke, and marble that underlie the western part of Mansfield Peninsula from Point Retreat to the south boundary of the quadrangle are here named the Retreat group. The dominant rock types are fine-grained gray to greenish-gray sericite schist, sericite-chlorite-albite schist, medium-grained quartz-muscovite schist, fine-grained green chlorite-albite-epidote schist, black graphitic, quartzose, pyrite-bearing slate, and black graphitic slate. Gray fine- to medium-grained graywacke and silvery sericite schist form a minor portion of this group. Gray to buff marble with dark-gray laminae in beds 0.5 foot to more than 100 feet thick is exposed 0.6 mile and 0.8 mile north of False Point Retreat, at The Kittens, intermittently along the beach on the western side of Mansfield Peninsula for a distance of 2 miles north from the southern boundary of the quadrangle, and on the north side of Funter Bay. Minor folding is intense at Funter Bay and north of False Point Retreat, so the stratigraphy could not be definitely determined. However, two layers of marble with intercalated greenschist and quartz-sericite schist probably are present.

The thickness of the Retreat group is at least 6,000 feet, before allowance is made for repetition by folding—a factor that cannot be assessed in view of the lack of mappable marker beds. Individual beds of all the above-mentioned rock types are a few inches to a few hundred feet thick. A black graphitic slate unit underlying the east flank of the ridge east of Funter Bay has an apparent thickness of about 5,000 feet, but multiple repetition by minor folding is probable.

The planar schistosity is parallel to bedding on limbs of folds and on open minor folds. At noses of sharp, angular, minor folds it is parallel to the axial planes. Cleavage in the slate is parallel to bedding only on limbs of folds and is parallel to axial planes of minor folds. The planar schistosity strikes mostly N. 20°-40° W. and dips steeply eastward, except between Point Retreat and False Point Retreat and at Funter Bay where the dips are highly variable and low attitudes are common. Axes of minor folds plunge gently northwestward north of the latitude of False Point Retreat, and gently southeastward south of that latitude. The sericitic and chloritic schists show a pronounced lineation of elongate minerals, clusters of minerals, and small furrows in the planar schistosity.

The upper portion of the Retreat group, the slate, greenschist, and sericite schist that crop out along the west side of Barlow Cove, is believed by the writer to be equivalent to the lithologically similar upper part of the Treadwell formation, which lies on the opposite side of the Shelter syncline and is of probable Jurassic to Early Cretaceous age. The lower part of this group, the greenschist, sericite schist, and marble that crop out along Lynn Canal and Funter Bay, may also be of the same age, but it is more likely that these rocks are equivalent to the Upper Triassic greenschist, slate, and marble of the Juneau area, and to Upper Triassic rocks of southern Admiralty Island that underlie Lower Cretaceous conglomerate, graywacke, and slate. The only known probable Jurassic rocks on Admiralty Island are interlayered sandstone and volcanic rocks at Windfall Harbor (Martin, 1926, p. 255), 32 miles south of the quadrangle.

Treadwell formation.—The interlayered slate, volcanic flow breccia, graywacke, tuff, and schist that underlie the northeastern corner of the mainland along and east of Peterson and Auke Nu Creeks are the northwesterly extension of the Treadwell slate of the Juneau area (Eakin, 1922, map). The Treadwell formation is a part of the Berners formation of Knopf (1912, p. 15-20), a term not used in this report.

Black, graphitic slate and interlayered gray to green, fine-grained, poorly schistose to massive plagioclase-quartz-sericite-chlorite graywacke form the bulk of this formation. All gradations between the two rock types are present (Knopf, 1912, p. 16). Lenses of green, massive flow breccia, which are of basaltic composition and contain euhedral crystals of augite as large as one inch, are interlayered with the slate and graywacke. The mountainside above 2,000 feet altitude east of Windfall Creek is underlain by interlayered silvery gray to dark gray sericite schist, fine-grained dark-gray graywacke, and gray-green sericite-chlorite-feldspar schist.

The thickness of the Treadwell formation is not known, but probably is at least several thousand feet. Owing to the extreme scarcity of exposures, the number and extent of minor folds and resultant repetition of beds cannot be determined.

No fossils have been found in these rocks. Plant remains of probable Jurassic or Early Cretaceous age were found by Knopf (see Martin, 1926, p. 258-260) at Berners Bay in strata that probably are equivalent to the Treadwell formation. The Treadwell slate in the vicinity of Juneau, which lies 10 miles east of Outer Point, stratigraphically overlies the Jurassic(?) Thane and Upper Triassic Gastineau volcanic groups (Eakin, 1922, cited by Martin, 1926, p. 247).

Barlow Cove formation.—This formation (new name) extends from the south boundary of the quadrangle northward to Barlow Point and Hump Island. Excellent exposures are found along the eastern shore of Barlow Cove, the type locality. It consists largely of chlorite-epidote-albite schist with minor amounts of augite-bearing volcanic flow breccia, andesite, quartz-pebble graywacke conglomerate, laminated massive homogeneous graywacke, and black slate. A well-defined member of chlorite-epidote-albite schist, slate, graywacke, and quartz-pebble conglomerate, approximately 300 to 800 feet thick, extends from Barlow Cove to Lone Mountain and delineates the Lone Mountain fold. The total thickness of the Barlow Cove formation is approximately 6,500 feet, without allowance for repetition by minor folds. The laminated graywacke and slate of the Symonds formation conformably overlie the uppermost Barlow Cove greenschist with a sharply defined contact. The Barlow Cove formation appears to be in contact with the Retreat group along a bedding fault.

The chlorite-epidote-albite schist is believed to have been derived from basalt flows and possibly from ash falls of similar composition. The flows and ash falls probably were deposited simultaneously with the augite-bearing volcanic flow breccias of the Jurassic(?) to Lower Cretaceous(?) Douglas Island volcanic group, which are discussed below. The augite-bearing volcanic flow breccia of the Barlow Cove formation is identical to the flow breccias of the Douglas Island group. The Barlow Cove formation probably is of Jurassic(?) to Early Cretaceous(?) age.

Douglas Island volcanic group.—The augite-bearing volcanic flow breccias and minor interlayered laminated graywacke and tuff of the Douglas Island volcanic group (named by Eakin, 1922, after exposures on eastern Douglas Island) are almost continuously exposed along the coast and at adjacent islands from Auke Bay to Amalga Harbor, and they underlie Auke Mountain and the connecting ridge to the north. The flow breccia consists of angular to subrounded fragments of green to dark-green augite basalt as large as 0.5 m and euhedral and subhedral green to black augite chrystals 1 to 25 mm in maximum dimension set in a massive, yellow-green to very dark green, very fine grained matrix of chlorite, pseudomorphs of sericite after plagioclase, chalcedony, andesine, and epidote. The average maximum dimension of the fragments of augite basalt is 2 to 3 inches, and they commonly comprise 5 to 20 percent of the breccia.

Fine- to coarse-grained, dark-gray plagioclase-quartz graywacke, which is mostly coarsely laminated, is interlayered with flow breccia at Coghlan Island, from Point Louisa to Point Lena, at Lena Cove, and on the north side of Auke Bay. The graywacke layer that extends from Point Lena to Coghlan Island is shown on the geologic map; other similar layers are too small to be shown on the map. Finely laminated, waterlaid tuff, showing penecontemporaneous deformation, crops out on the mainland 0.6 mile northeast of Cohen Island.

The Treadwell formation is conformable with the stratigraphically overlying Douglas Island volcanic group. The two units meet in a zone of interlayered slate, flow breccia, and graywacke that is a few tens to several hundred feet thick.

The contact of the Douglas Island volcanic group with the rocks to the west is concealed by Favorite Channel. Hence the total thickness of this group cannot be measured; it is estimated to be at least 5,000 feet and probably 10,000 feet. Marked variations in dip of the strata are common, but minor folding does not appear to be widespread.

The augite-bearing flow breccias were extruded after growth of phenocrysts of augite and plagioclase (labradorite?). Crusts that formed on the flowing masses of lava were broken, and the fragments incorporated into lava before final solidification. During folding and attendant mild metamorphism the plagioclase phenocrysts were sericitized, much very fine grained pyroxene in the matrix was chloritized, and epidote was formed from plagioclase and pyroxene. The polygranular aggregates of chalcedony, one-twentieth mm to 1 mm in diameter, may have formed before, rather than during, the metamorphism.

The Douglas Island volcanic group was regarded as of probable Late Jurassic age by Eakin (1922), because it lies above the Upper Triassic Gastineau volcanic group, the Thane volcanic group, and the Treadwell slate. No fossils are known from the Douglas Island volcanic group. It is in gradational contact with the stratigraphically overlying Lower Cretaceous(?) Symonds formation and so may be in part of Early Cretaceous(?) age. This formation is here classed as Jurassic(?) to Early Cretaceous(?) in age.

Symonds formation.—Interlayered gray to dark-gray graywacke and black slate of the Symonds formation (new name) crop out along the eastern shore of Admiralty Island from Symonds Point, the type locality, to the southern boundary of the quadrangle, on Horse, Colt, and Portland Islands, and on parts of Lincoln, Shelter, Hump, and Douglas Islands. Fine- to coarse-grained carbonaceous plagioclase-quartz-sericite-chlorite graywacke, much of which is laminated in layers one-quarter inch to several inches thick, forms the bulk of this formation. Clastic grains of subrounded to angular heavily sericitized plagioclase and clear quartz, one-eighth millimeter in average dimension, are set in a very fine grained partly schistose aggregate of sericite, chlorite, and graphite. Some of the graywacke contains abundant detrital grains of greatly altered andesite or basalt porphyry. Very fine grained black graywacke and black slate are next in abundance. Secondary calcite is present in much of the graywacke. Augite-bearing volcanic flow breccia is conformably interlayered with the graywacke and slate on Horse and Douglas Islands. Layers of pebbly graywacke crop out on Portland Island, George Rock, and along Fritz Cove on the north side of Douglas Island. A 15-foot thick layer of brown marble forms the basal unit of the Symonds formation at the contact with the Barlow Cove formation on Hump Island.

Greenstone sills, dikes, and flows(?) lie in slate of the Symonds formation along the northeast shore of Shelter Island between the latitudes of Aaron Island and Eagle Reef. Most of these tabular bodies are parallel to the cleavage and bedding (?) of the slate, and they range in thickness from several inches to several feet. The greenstone is a light-green, massive, chlorite-albite-epidote rock that is similar to the greenstone of the overlying Shelter formation.

The Symonds formation is largely concealed by the waters of Stephens Passage and Saginaw and Favorite Channels, and its thickness cannot be measured. However, this unit is believed to be at least 5,000 and possibly 10,000 feet thick. Minor folding is prevalent on Douglas Island and is common in the remainder of the formation.

The graywacke of the Symonds formation is identical mineralogically with the graywacke of the Douglas Island volcanic group at Point Louisa and with the graywacke of the Barlow Cove formation. Also, the augite-bearing volcanic breccia in the Symonds formation at Horse Island is similar to that of the Douglas Island volcanic group. These similarities in petrographic characteristics imply similarities in depositional environment. The period of time that elapsed between deposition of the Symonds formation and the two older, stratigraphically underlying units probably was not great.

Graywacke, slate, and conglomerate, similar in petrographic characteristics to the Symonds and Shelter formations, extend from Douglas Island to the south-southeast along Seymour Canal on Admiralty Island, with an offset to the southwest to Pybus Bay (Wright, 1906, pl. 33). Rocks at the latter locality contain the Early Cretaceous *Aucella* fauna. The Symonds and Shelter formations, therefore, may tentatively be classed as of the same age.

Shelter formation.—This formation (new name) extends the length of Shelter Island, and crops out at the north end of Portland Island. It consists of conglomerate with interlayered pebbly graywacke, graywacke, and greenstone. The conglomerate consists of rounded, stretched pebbles of slate, chert, gray felsite, and graywacke, about an inch in average maximum length, set in a matrix of gray, coarse-grained graywacke. The stretched pebbles show a marked lineation in most exposures, plunging very gently to the southeast or south, parallel to the axes of minor folds. The conglomerate ranges from a rock with 40 percent pebbles (by volume) through pebbly graywacke to graywacke. Greenstone overlies the conglomerate and graywacke in the central and northern part of Shelter Island. It is a massive, very fine grained chlorite-albite-epidote rock with aggregates of opaque, white clay representing relict laths of plagioclase. The parent rocks probably were flows and sills of basalt or andesite that contained 10 to 20 percent of plagioclase phenocrysts.

Strata of the Shelter formation as exposed on Shelter Island may grade by a facies change into the Symonds formation on Douglas Island, may pass between that island and Colt Island, or both. Similar conglomerate is found to the southeast on Admiralty Island at Point Young and along Seymour Canal.

The conglomerate and graywacke of the Shelter formation are about 500 to 1,000 feet thick. The stratigraphically overlying greenstone is at least several hundred feet thick and may be much thicker. Minor folds are prevalent in much of this unit and make measurement of the true thickness impossible.

INTRUSIVE ROCKS

Quartz diorite.—A pluton of quartz diorite underlies the western part of Mansfield Peninsula from False Point Retreat to Funter Bay. It is well exposed along Lynn Canal, and frost-shattered outcrops are common along the discontinuous ridge that rises steeply from the shore. The quartz diorite is light gray to greenish gray, fine-to medium-grained, and homogeneous. A faintly to clearly visible foliation is given by flakes of biotite. A well-defined ubiquitous lineation is imparted by elongate grains of plagioclase, by lenticular aggregates of plagioclase and quartz that are crudely bounded by grains of biotite, and locally by biotite-rich, cigar-shaped clots. Grains of albite-oligoclase, 0.5 mm to 2 mm in length, are set in a seriate matrix of anhedral albite-oligoclase, quartz, and biotite, one-twentieth to one-quarter millimeter in maximum dimension. Minor amounts of epidote, garnet, magnetite, hornblende, and chlorite are present.

Sheets of biotite-chlorite schist, ranging from several inches to about 5 feet in thickness, lie in the quartz diorite along much of the shoreline exposure. These sheets irregularly pinch and swell along the strikes, and their contacts with the quartz diorite are sharp and in part are irregularly folded with subhorizontal axes. The foliation of the quartz diorite is parallel to the schistosity of the schist. Sheets of schist were seen only in the scattered exposures of quartz diorite on the ridge east of Lynn Canal within 2 miles of the southern boundary of the quadrangle. Apparently, sills were intruded in a zone peripheral to the main pluton, and the tabular bodies of wall rock separating the sills are now biotite-chlorite schist.

The form and contacts of the intrusive body have been controlled by the schistosity of the Retreat group, and hence the quartz diorite was intruded after formation of the schistosity. The pluton must have solidified prior to cessation of the folding of the enclosing strata, because the quartz diorite has a sheared, almost flaser structure, and because the gently plunging lineations in the quartz diorite and in the included slabs of schist are parallel to those in the wall rock. The biotite-chlorite schist that is included in the western and southern margins of the pluton is of distinctly higher metamorphic rank than the rocks of the adjacent Retreat group, which do not contain biotite. This local rise in rank is attributed to heat derived, during formation of the schist, from crystallization and cooling of the quartz diorite. Growth of garnet in the quartz diorite strongly suggests metamorphism of the quartz diorite. The foregoing evidence indicates that the quartz diorite was intruded during the orogeny, solidified, and was deformed and metamorphosed in a later stage of the orogeny.

Gabbro.—Hornblende gabbro underlies much of Lincoln Island, and a sill of uralite gabbro, 300 feet in thickness, intrudes conglomerate at the north end of Shelter Island. The hornblende gabbro bodies are massive and consist of phenocrysts of hornblende and altered pyroxene, 1 to 10 mm in length, set in a very fine grained, yellow-green matrix of completely altered plagioclase. Stubby anhedral prisms of fresh hornblende form 25 percent of the gabbro, almost wholly uralitized and chloritized subhedral augite forms 15 percent, and octahedra of magnetite, many of which are partially altered to chlorite, form 3 to 4 percent. The original plagioclase has been transformed to a very fine grained aggregate of epidote, sericite, albite, and chlorite. Pegmatitic variants of the gabbro, with grains of hornblende as long as 2 inches, are irregularly distributed in the pluton. Thin dikes of fine-grained gabbro cut the older gabbro. Dark hornblende-rich clots and schlieren occur sporadically in the intrusive body. Veinlets of epidote, 1/4 to 1 inch in thickness, are scattered in the gabbro. The uralite gabbro on Shelter Island consists of completely sericitized plagioclase, uralitized pyroxene, and magnetite, with secondary quartz, chlorite, and leucoxene. Alteration of the gabbro is believed to be entirely deuteric, caused by abnormally high amounts of residual volatiles in late fractions of the gabbro magma.

Contacts of the gabbro with the country rock are sharp, and, where observed, are parallel to bedding and cleavage. The contact that extends under the water eastward from Lincoln Island either transects the structure of the Symonds formation or encounters a fault of displacement greater than 1.3 miles. The former is more probable. On Lincoln Island at the west boundary of the quadrangle the gabbro is in contact with highly contorted, interlayered argillaceous marble and slate; axes of the ptygmatic-like folds plunge steeply down the dip of the bedding. Such folds were seen only at the contact in this locality; at a distance of more than 200 feet from the contact the minor folds show the low plunges that are found throughout the remainder of the quadrangle. The intense deformation of easily folded marble beds at the contact with the gabbro was caused by stresses generated during intrusion. The gabbro has not been deformed and metamorphosed, and so must be younger than the quartz diorite.

Augite diorite.—Three mappable sills of altered augite diorite have intruded slate on the broad ridge between Peterson and Windfall Creeks. Other bodies of augite diorite, too small to be shown on the geologic map, are present. This rock is gray, massive, and medium grained; it consists of approximately 65 percent partially sericitized albite, 10 percent biotite, 10 percent chlorite, 10 percent microcline, 3 to 4 percent quartz, and accessory magnetite, leucoxene, apatite, and epidote. Biotite and chlorite have formed as fine-grained clusters, some of which show outlines of original augite (?) and hornblende (?). Microcline has irregularly replaced albite grains, forming patch perthite. Partial pseudomorphs of all proportions of albite and microcline are present. The augite diorite probably is younger than the metamorphosed quartz diorite. The relative ages of the gabbro and the augite diorite are not known.

Basalt and andesite dikes.—These bodies, averaging 1 to 4 feet in thickness, have been injected along the prominent set of joints that is normal to subnormal to the axes of minor folds; hence they strike northeast and dip steeply. All are too small to be shown on the geologic map.

STRUCTURAL GEOLOGY

FOLDS

Shelter Island syncline.—This fold is the major structural feature of the Juneau (B-3) quadrangle. The syncline is isoclinal, overturned to the southwest, and plunges about 14° to the southeast. The rocks on the northeast limb are overturned, except for dragged limbs of minor folds. The conglomerate unit of the Shelter formation on the northern end of Shelter Island has been intensely folded on the southwest limb of the fold. The outcrop breadth of this unit has been greatly increased by these minor folds and associated low dips. The conglomerate is poorly exposed on the southern half of Shelter Island, therefore the syncline could not be mapped accurately in that area.

Lone Mountain fold.—The large drag fold in the Barlow Cove formation plunges very gently to the southeast. The anticlinal part of the fold has steeply dipping limbs and is much tighter than the synclinal part, whose southwest limb dips gently to the northeast. This fold was not found in the poorly exposed rocks that lie southeast of the prominent fault extending from Stephens Passage to Funter Bay.

Funter anticline.—The nose of this anticline, as shown by the marker unit of marble, is on the southeastern side of Funter Bay (Reed, 1942, pl. 51), just south of the quadrangle. The fold plunges very gently to the south-southeast. The marble bed on the eastern, gently dipping limb of the fold passes immediately west of Funter. Similar marble beds are exposed 0.4 mile east-northeast of Funter, for 2 miles along Lynn Canal, at The Kittens, and 0.6 and 0.8 mile north of False Point Retreat. The marble layers at Funter Bay probably extend northward along Mansfield Peninsula to the outcrops north of False Point Retreat, with a partial interruption by the quartz diorite pluton. The axis of the Funter anticline probably plunges gently to the north-northwest near False Point Retreat, as suggested by axes of minor folds. The anticline, like the Shelter Island syncline, is overturned to the southwest.

Minor folds.—All the layered rocks in the quadrangle show minor folds. They are prevalent in the Retreat group and in the Symonds and Shelter formations. A few of the well-exposed folds are simple drag folds; some are abrupt irregularities in dip of the strata; others consist of several to many fold pairs, so that their shear senses cannot be determined. Most, however, are poorly exposed, and their shapes are not known. The minor folds are of little value in determining tops and bottoms of beds.

Minor folds in graywacke, slate, and conglomerate typically have noses that are rounded in cross section. Those in the schist and slate in the vicinity of Point Retreat have relatively angular noses and straight limbs, and show zigzag patterns in outcrop. The folds plunge at low angles to the southeast or south-southeast, except along the north shore of Funter Bay and the northernmost portion of Mansfield Peninsula, where they plunge gently northwest.

FAULTS

Two major systems of steeply dipping faults are present: transverse faults of northeasterly strike, and longitudinal faults of north-northwesterly strike. Both systems are apparent mostly in prominent linear topographic features—valleys, gulches, and marine depressions, and partly in shear zones and offset stratigraphic horizons. The quadrangle has been severely glaciated, and areas of weak, broken rocks have been gouged and later covered by surficial deposits and vegetation.

Longitudinal faults.—Faults of this system extend along Montana and Windfall Creeks, the valley at the head of Barlow Cove, the mountain south of Bear Creek, Douglas Island, and the central part of Shelter Island. All are prominent features on air photos. Barlow Cove, Favorite Channel, and Lynn Canal probably conceal longitudinal faults. The only direct evidence for existence of this system of faults is shear zones at Montana Creek, Douglas Island, and Shelter Island, and offsets on Shelter Island. The direction and amount of movement could not be determined, except for the two northwest-trending faults that displace poorly exposed conglomerate layers on central Shelter Island. The southerly of these two faults may offset the conglomerate 0.5 mile, measured horizontally.

Transverse faults.—This system of faults is prominent on Mansfield Peninsula and on Shelter Island. Four transverse faults have been mapped on the mainland from air photos. Horizontal components of displacement of the two transverse faults that cross the northern half of Shelter Island are about 0.7 mile for the northerly fault and 0.5 mile for the southerly one. On each fault the southeast side has been displaced to the southwest, relative to the northwest side. The relative horizontal motion may also be classed as right lateral. The vertical components of movement are not known. Movement on the transverse faults of Mansfield Peninsula and the mainland could not be determined, owing to poor exposures.

The transverse faults appear to terminate at the major longitudinal faults, except the one that extends from Stephens Passage to Funter Bay. The terminations of the faults are either at acute angles or the transverse faults swing into tangential intersections with the longitudinal faults.

Minor faults.—Many faults, too small to be mapped on a scale of 1:63,360, are present in the quadrangle. Their strikes are not regular, and their dips are steep to vertical. Offsets of as much as 40 feet along these faults are not uncommon. Minor faults are especially abundant in the vicinity of Outer Point, on Douglas Island, where they cut minor folds.

MINERAL DEPOSITS

The northeastern part of the Juneau (B-3) quadrangle lies in the Juneau gold belt. All the prospects are either gold-bearing quartz fissure veins or bodies of similar mineralogy that have replaced slate and schist. Arsenopyrite is the dominant sulfide mineral, and traces of pyrite, chalcopyrite, pyrrhotite, galena, and sphalerite are present in many of the deposits.

No mining or active exploration work has been done in the area since before World War II. Most of the known prospects were discovered between 1900 and 1910; examination of them now is not fruitful, because the surface and underground workings are slumped and caved, and the dumps are densely overgrown with brush. The following descriptions of prospects on the mainland are taken from Knopf (1912, p. 53-58) and are given for the convenience of readers who do not have access to Knopf's report.

The Prairie claims lie 0.7 mile east of Peterson Lake. Auriferous arsenopyrite-bearing quartz masses lie in gently dipping black slate. The quartz bodies are roughly tabular, and lie parallel to the cleavage of the slate. They may be as wide as 30 feet at the surface, and as long as 350 feet. Several hundred tons of ore were said to average $10 per ton in gold.

The Treasury Hill claims lie 2.4 to 2.8 miles north of Auke Bay and 0.1 to 0.3 miles west of the eastern boundary of the quadrangle. A mineralized and greatly altered dike, about 50 feet wide and more than 500 feet long, underlies the northern claims. The dike consists mostly of albite, with minor chlorite, carbonate, sericite, arsenopyrite, and pyrrhotite. Many quartz veins cut the dike, which trends about N. 35° W. Many bodies of quartz underlie the southern claims in an area that extends about 400 feet along the strike of the enclosing slate and albite-chlorite schist, and 200 to 300 feet across the strike. The quartz contains coarse gold and minor amounts of arsenopyrite and pyrite.

A mass of auriferous arsenopyrite-bearing quartz was explored at the Smith and Heid property, which is near the eastern boundary of the quadrangle at the head of Windfall Creek. The country rock is black schistose graywacke, which is irregularly impregnated with pyrite and arsenopyrite. Silvery sericite schist lies just to the northeast; it contains galena, sphalerite, and pyrite, and traces of arsenopyrite and chalcopyrite. Gold values are not given by Knopf.

Wright (1906, p. 150) briefly described the Portage group of claims, which lies about half a mile west of the lake near the head of Bear Creek portage. Irregular to tabular masses of quartz lie in slate with their larger dimensions parallel to the cleavage. The quartz contains pyrite and chalcopyrite, and traces of galena. The ore was classed as low grade.

GEOLOGIC HISTORY

The geologic history of the Juneau (B-3) quadrangle may be summarized as follows:

1. Deposition of sediments and volcanic flows and tuffs of the Treadwell, Retreat, Douglas Island, Barlow Cove, Symonds, and Shelter units in Late Triassic (?) to Early Cretaceous (?) time.
2. Folding and low-rank metamorphism in Cretaceous time.
3. Intrusion of the quartz diorite in a late stage of the folding.
4. Intrusion of the gabbro and the augite diorite.
5. Transverse, longitudinal, and minor faulting.
6. Erosion.
7. Glaciation in Quaternary time.
8. Deposition of alluvium in postglacial Quaternary time.

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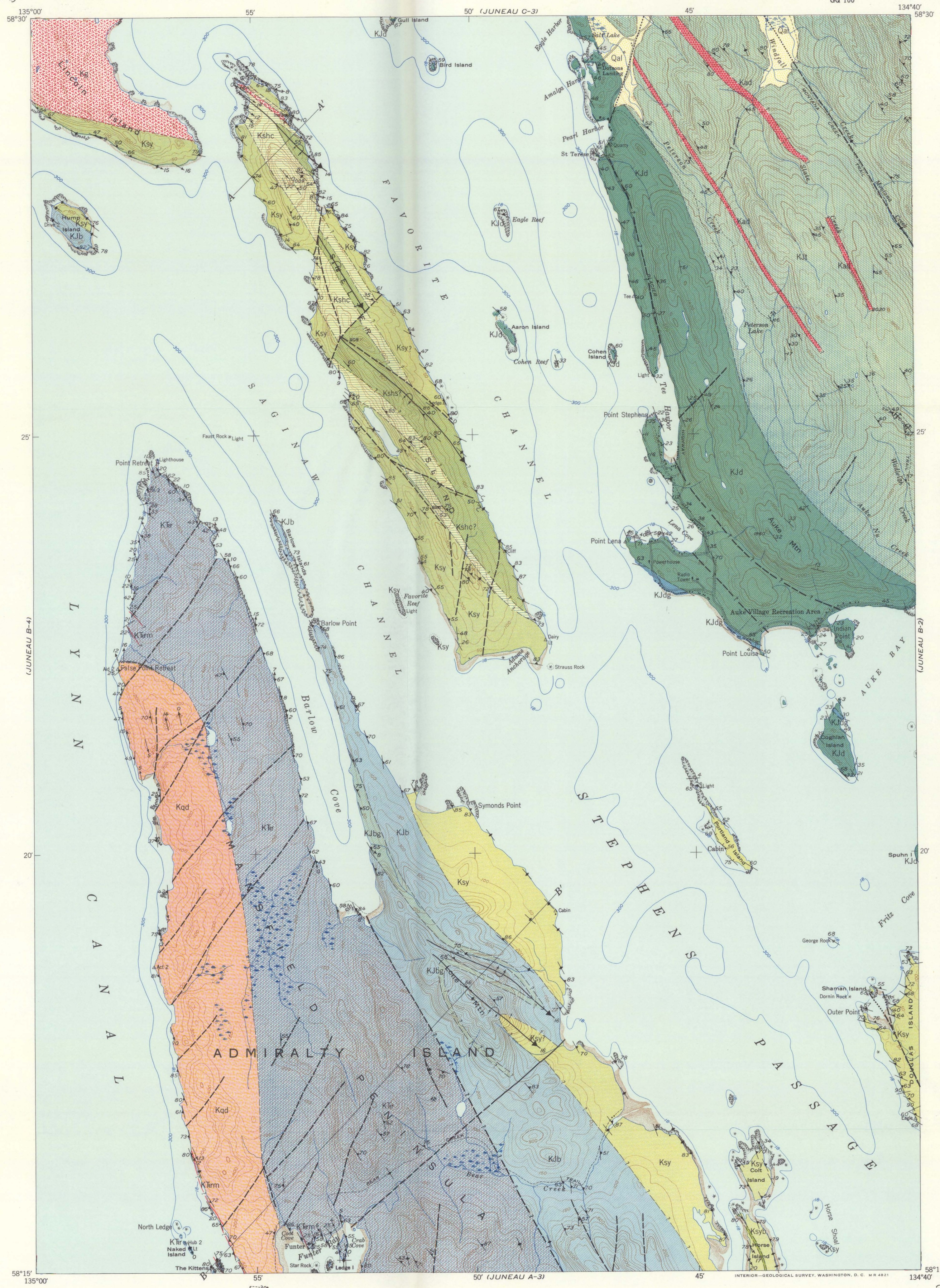
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEOLOGY OF THE
JUNEAU (B-3) QUADRANGLE
ALASKA
GQ 100



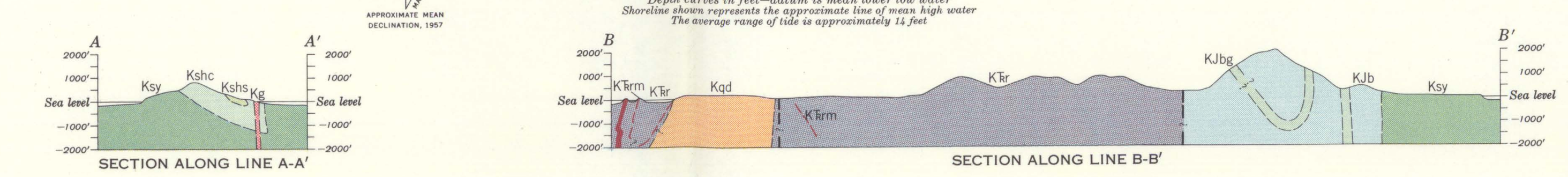
Base map by Topographic Division
U.S. Geological Survey, 1947

TRUE NORTH
MAGNETIC NORTH
30°
APPROXIMATE MEAN DECLINATION, 1957

Scale 1:63360
1 ½ 0 1 2 3 Miles

Contour interval 100 feet
Dotted lines represent half-interval contours
Datum is mean sea level
Depth curves in feet—datum is mean lower low water
Shoreline shown represents the approximate line of mean high water
The average range of tide is approximately 14 feet

Geology mapped in 1954 and 1955



SECTION ALONG LINE A-A′

SECTION ALONG LINE B-B′

EXPLANATION

QUATERNARY

Recent

Qal — Alluvium
Gravel, sand, and silt.

INTRUSIVE ROCKS

CRETACEOUS(?)

Lower Cretaceous(?)

Kad — Augite diorite
Altered augite-hornblende diorite.

Kg — Gabbro
Sericitized hornblende-uralite gabbro; sericitized uralite gabbro on Shelter Island.

Kqd — Quartz diorite
Lineated, foliated, sheared albite-oligoclase-quartz-biotite quartz diorite.

LAYERED ROCKS

Kshs, Kshc — Shelter formation
Black slate and greenstone, Kshs; conglomerate with pebbles of slate, chert, felsite, and graywacke, and graywacke matrix, Kshc.

Ksyb, Ksy — Symonds formation
Dark-gray to black carbonaceous plagioclase-quartz-sericite-chlorite graywacke, slate, and conglomerate, Ksy; augite-bearing volcanic flow breccia, Ksyb.

TRIASSIC(?) TO CRETACEOUS(?)

Southwest limb of Shelter syncline

Jurassic(?) to Lower Cretaceous(?)

KJbg, KJb — Barlow Cove formation
Chlorite-epidote-albite schist, with minor augite-bearing volcanic flow breccia and andesite flows, KJb; greenschist, graywacke, slate, and conglomerate, KJbg.

Upper Triassic(?) to Lower Cretaceous(?)

KŦr, KŦrm — Retreat group
Sericite schist, greenschist, slate, and graywacke, KŦr; gray marble, KŦrm.

JURASSIC(?) TO CRETACEOUS(?)

Northeast limb of Shelter syncline

Jurassic(?) to Lower Cretaceous(?)

KJdg, KJd — Douglas Island volcanic group
Augite-bearing volcanic flow breccia with minor tuff, KJd; dark gray to black plagioclase-quartz graywacke, KJdg.

KJt — Treadwell formation
Slate, augite-bearing volcanic flow breccia, graywacke, tuff, and sericite schist.

Contact
Dashed where approximately located.

Probable contact

Concealed contact

Irregular contact

Fault
Dashed where approximately located.

Probable fault

Concealed fault

Overturned anticline
Showing trace of axial plane, direction of dip of limbs, and bearing and plunge of axis.

Overturned syncline
Showing trace of axial plane, direction of dip of limbs, and bearing and plunge of axis.

Strike and dip of beds
Top of beds not shown.

Strike of vertical bedding

Generalized strike and dip of crumpled, crenulated, plicated, or undulating beds

Strike and dip of foliation or schistosity

Strike of vertical foliation or schistosity

Horizontal foliation or schistosity

Bearing and plunge of lineation

Strike and dip of foliation or schistosity and plunge of lineation

Pit, adit, or shaft

GEOLOGIC MAP
OF THE
JUNEAU (B-3) QUADRANGLE, ALASKA
By
Fred Barker
1957