Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1968

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CONTRIBUTIONS TO STRATIGRAPHY

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CONTENTS

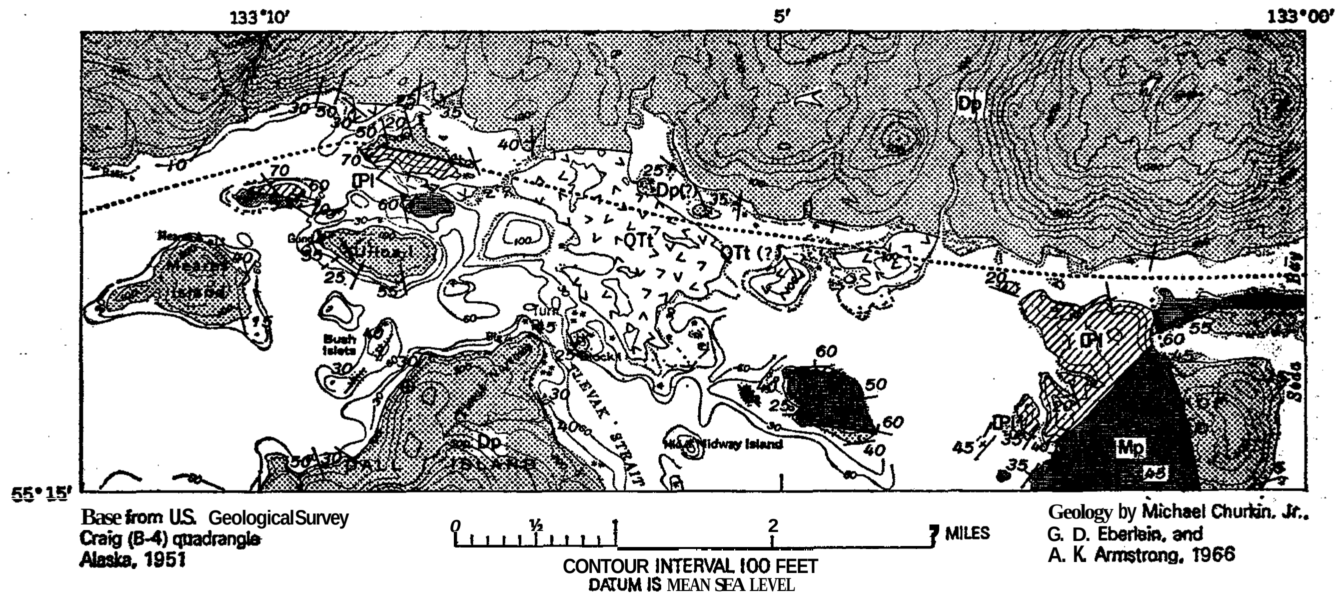
ILLUSTRATIONS

TLEVAK BASALT, WEST COAST OF PRINCE OF WALES ISLAND, SOUTHEASTERN ALASKA

By G. DONALD EBERLEIN and MICHAEL CHURKIN, JR.

A number of small islands off the west coast of Prince of Wales Island at the latitude of Ketchikan (fig. 1) are underlain by one or more basalt flows. These flows are best exposed along the shoreline. The flowe make up a new formation, here named the Tlevak Basalt for its occurrence in the vicinity of Tlevak Strait (fig. 1). The basalt is probably flat lying, and the low relief of the shoreline exposes only a few feet of lava at any locality.

Generally the basalt is strongly jointed and forms thin subhorizontal slabs. In places there are well-developed closely spaced concentric fractures along which the rock weathers spheroidally. Locally, the


133°10'
5'
133°00'
55°15'
Dp
Pl
Dp(?)
QTt
QTt (?)
Bush Islets
Midway Island
Mp
Dp
Base from U.S. Geological Survey
Craig (B-4) quadrangle
Alaska, 1951
0 ½ 1 2 3 MILES
CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL
Geology by Michael Churkin, Jr.,
G. D. Eberlein, and
A. K. Armstrong, 1966

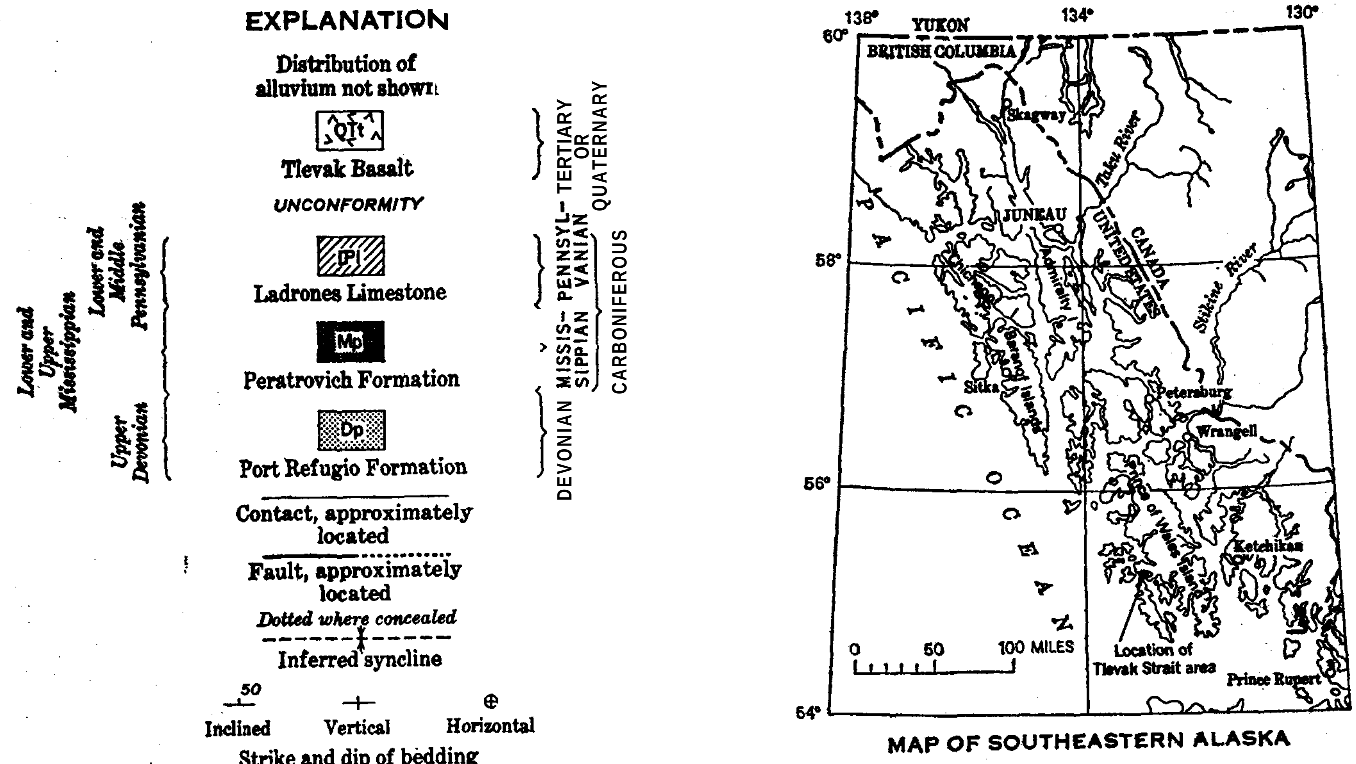


FIGURE 1.—The Tlevak Strait area, southeastern Alaska.

basalt has vertical columnar joints that are transected by the subhorizontal fracture system.

In contrast to the Paleozoic formations which predominate in this region, several of which contain basaltic volcanic rocks, the Tlevak Basalt is remarkably fresh and contains phenocrysts of olivine and plagioclase (labradorite) in an intergranular groundmass of labradorite microlites, olivine, and subordinate clinopyroxene. The rock has a normative mode and may be classified as olivine basalt according to the scheme of Yoder and Tilley (1962).

On the south shore of a small unnamed island about 1 mile northwest of the north entrance to Tlevak Strait, the Tlevak Basalt unconformably overlies steeply dipping beds of the Ladrones Limestone. Elsewhere, in discontinuous exposures, the Tlevak apparently overlies the Port Refugio and Peratrovich Formations. The Tlevak Basalt thus appears to rest unconformably upon Pennsylvanian, Mississippian, and Upper Devonian formations. A small area of similarly fresh olivine basalt is exposed along the northeast shore of Trocadero Bay about 9 miles northeast of the area of this report. This olivine basalt may overlie a formation older than the Port Refugio, the Descon Formation.

The top of the Tlevak Basalt is not exposed, and its total thickness is uncertain. Judging from its inferred gross subhorizontal structure and the maximum relief adjacent to shoreline exposures, it is probably less than 100 feet thick.

The Tlevak Basalt is demonstrably younger than the Ladrones Limestone and therefore is post-Pennsylvanian. It is tentatively assigned a Tertiary or Quaternary age because of its freshness and general lack of deformation.

THE CANTWELL FORMATION OF THE CENTRAL ALASKA RANGE

By JACK A. WOLFE and CLYDE WAHRHAFTIG

NAME AND TYPE AREA

The Cantwell Formation was first described by Eldridge (1900, p. 16) as the Cantwell Conglomerate from exposures in the canyon of the Nenana River, then called the Cantwell River. Its type locality is considered to be the east wall of the canyon of the Nenana River from the mouth of Slime Creek northward for about 7 or 8 miles in the Healy C–4 quadrangle (fig. 4, loc. 1). This type locality agrees with Eldridge's original text (1900, p. 1) but not with his map (map 3) nor with the statement in Wahrhaftig (1958, p. 8), both of which are in error.

DIBTRIBUTION

The Cantwell Formation occupies a large synclinorium extending along the center of the Alaska Range from the headwaters of the Wood River westward to the Muldrow Glacier (fig. 4). Brooks and Prindle (in Brooks, 1911) and Reed (1961) have mapped bodies of the Cantwell farther southwest along the north base of the range. Capps (1933) mapped a large area of the Cantwell Formation on the south side of the Denali fault between Foggy Pass and Anderson Pass, an area separated from the main body of the Cantwell by a belt of Paleozoic and Triassic rocks along the north side of the fault.

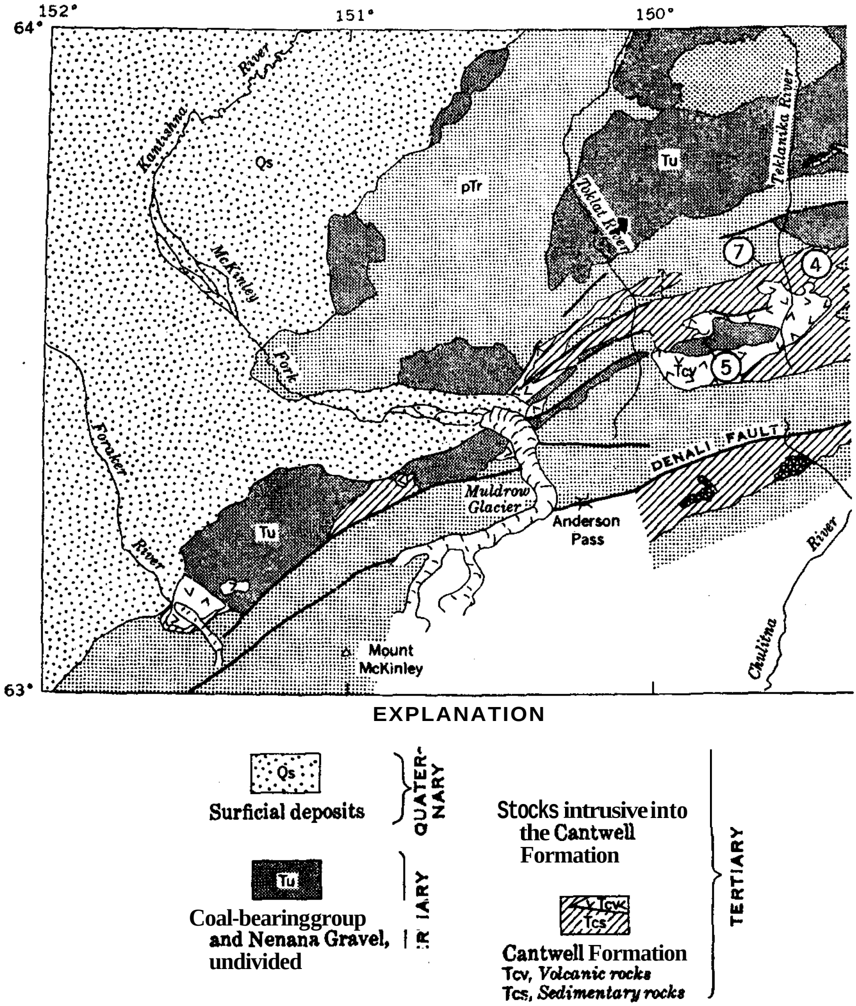
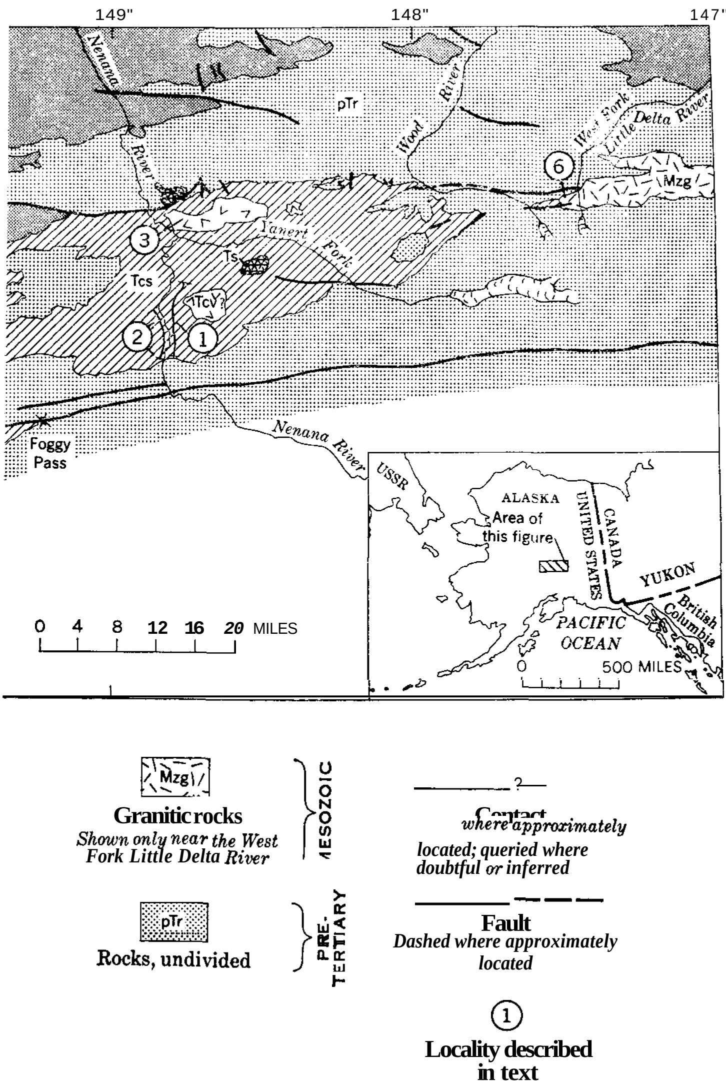


FIGURE 4.—Geologic sketch map of the central Alaska Range showing distribu-
text. Geology modified from Reed (1961, pl. 1),



tion of the Cantwell Formation, related formations, and localities referred to in Wahrhaftig (1958, pl. 1), and Capps (1912, pl. 2).

LITHOLOGY

The Cantwell Formation consists predominantly of interbedded conglomerate, sandstone, argillite, shale, and coal but also contains volcanic rocks, especially near its top. The Cantwell is intruded by an abundance of sills and dikes ranging in composition from diabase to rhyolite and by monzonite stocks as much as 3 to 4 miles across.

At two localities the Cantwell Formation is clearly younger than large intrusive bodies. (1) At the pass between the headwaters of the Wood River and the West Fork Little Delta River (fig. 4, loc. 6), it rests unconformably on granodiorite and quartz monzonite at the west end of a large batholith which was traced eastward by Capps (1912, pl. 2) as far as Delta Creek, a distance of 30 miles; the granodiorite beneath the contact has been weathered to grus for a thickness of 20 feet. (2) On the east side of the Muldrow Glacier, dikes believed to be feeders to the volcanic rocks of the Cantwell Formation cut the intrusive body underlying Mount Eielson (Reed, 1933).

The Cantwell Formation is generally moderately well consolidated and is locally very well indurated. Some beds in the formation are extremely well sorted pebble conglomerate consisting of quartz, chert, quartzite, and argillite pebbles with little or no matrix. Few of the pebbles are less than half, or more than twice, the median size, The pebbles are indented and moulded against each other, possibly as a result of solution and redeposition of silica under tectonic pressure; the conglomerate therefore has negligible porosity.

Coal in the Cantwell Formation is generally of bituminous rank, even where beds are tightly folded and the conglomerate compressed, as in the vicinity of mafic dikes.

Dark flows and rhyolite tuffs occupy an open syncline centered on Mount Fellows (fig. 4, loc. 3). A belt of predominantly silicic volcanic rocks is exposed at the top of the formation from Double Mountain (fig. 4, loc. 4) westward to the Muldrow Glacier. These silicic volcanic rocks give Polychrome Pass (fig. 4, loc. 5) its color variety. In both the Mount Fellows and Polychrome Pass areas, the volcanic rocks are at the top of the section, yet only 1,000 to 3,000 feet of sedimentary rocks lies between the volcanic rocks and the base of the formation. The volcanic rocks at Mount Fellows and Polychrome Pass may be equivalent to lower parts of the Cantwell Formation at other places, or they may have erupted in areas where highlands in the pre-Cantwell topography rose a few thousand feet above the base of the formation elsewhere.

The lithology of the clasts in the Cantwell Formation varies from place to place, suggesting that the formation was derived from at least three different sources. In the type area along the Nenana River, the sandstone and conglomerate are predominantly dark gray and consist largely of argillite, chert, quartzite, and quartz grains and pebbles. The source of this dark-gray facies was probably south of the Alaska Range, possibly in the Mesozoic rocks in the Talkeetna Mountains or the southern Alaska Range. Along the north edge of the area of outcrop of the Cantwell east of the Nenana River, this facies interfingers with light-brown to white sandstone and conglomerate consisting largely of schist fragments derived from the Birch Creek and Totatlanika Schists immediately to the north. From the vicinity of Polychrome Pass (fig. 4, loc. 5) westward, the dark-colored Cantwell is replaced by light-brown conglomerate and sandstone that consist largely of clasts of gray limestone in a light-brown matrix of unknown composition and origin. The westward limit of this light-colored limestone-bearing facies is unknown. Its source could have been the area of Devonian limestone near the crest of the range (and on the north side of the Denali fault) immediately south of its area of outcrop.

The limestone-bearing facies has not been mapped in the Cantwell Formation south of the Denali fault, as this body has not been visited since Capps' reconnaissance in 1930. A study of this facies and its correlation with facies north of the fault might give information on the lateral displacement of the fault since Paleocene time.

THICKNESS

The total thickness of the Cantwell Formation, whose upper surface has been eroded, is unknown. Generally, the thickness ranges from 2,000 to 5,000 feet. The maximum thickness is about 10,000 feet in a reference section (fig. 4, loc. 2) in the walls of the Nenana Canyon between Clear Creek and Carlo (Wahrhaftig, 1958, pl. 3) but may include an unknown thickness of sills.

AGE

The Cantwell Formation has had a varied history of age assignments. Eldridge (1900, p. 16), when first describing the Cantwell, was unable to assign an age to the formation. Brooks (1911, p. 78–83), who, with Prindle, mapped the Cantwell Formation from Mount McKinley to the Nenana River (fig. 4), correlated it on the basis of lithologic similarity with the Nation River Formation, then considered to be of Carboniferous age; but Brooks, in making this correlation had to explain away as faulted inliers beds containing plant remains which he had collected and which F. H. Knowlton reported to be Tertiary.

Moffit (1915) found plant fossils in rocks about 15 miles east of the Nenana that are similar to those of the type area. Knowlton and Hollick (in Moffit, 1915, p. 48) assigned these fossils to the Eocene but noted that Brooks' collections were similar. For 20 years thereafter, geologists working in Alaska were troubled by the fact that both the Cantwell Formation and an apparently much younger coal-bearing formation of the Nenana coal field to the north contained plants of supposed Eocene age.

In 1936, Ralph Chaney made new collections in the Cantwell at another highly fossiliferous locality and determined the fossils to be Cretaceous in age (Chaney, 1937), the age for the Cantwell quoted by Capps (1940, p. 118). In a further refinement of its age, Imlay and Reeside (1954, p. 235), noting the similarity of the plant species identified from the Cantwell by Chaney to those in the Upper Cretaceous Chignik Formation of the Alaska Peninsula and the Lower Cretaceous Melozi and Ealtag Formations of western Alaska, placed the Cantwell in the Lower Cretaceous Albian Stage.

Fossil plants have been collected from several localities in the Cantwell Formation, but only one locality, that of Chaney's collections, has furnished well-preserved and abundant material. Reexamination of Chaney's collections (Univ. of California Museum Paleont. loc. P3654—loc. 7 of fig. 4) indicates that the following taxa are present:

Glyptostrobus? sp.
Metasequoia occidentalis (Newb.) Chan.
Sparganium antiquum (Newb.) Berry
Planera microphylla Newb.
Cocculus flabella (Newb.) Wolfe
Cissus sp. aff. *C. marginata* (Lesq.) *R. W.* Br.
Grewiopsis auriculaecordatus (Holl.) Wolfe
Dicotylophyllum flexuosa (Newb.) Wolfe

All these named species are indicators of a Tertiary age; *Cissus marginata* is known from both Upper Cretaceous and Paleocene rocks (Brown, 1962). The species of *Planera,* Cocculus, *Grewiopsis,* and Dicotylophyllum were recorded from the Chickaloon Formation of the Cook Inlet region (Wolfe and others, 1966) and from other rocks thought or known to be of Paleocene age. Inasmuch as the particular species of these four genera have not been found in rocks younger than Paleocene, we therefore consider the known fossil plants to be indicative of a Paleocene age for the Cantwell Formation.

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