

DISCUSSION

Detailed stratigraphic and paleontologic studies conducted as an adjunct to the Mineral Resource Investigation of the Ugashik and Karluk quadrangles aimed primarily at mapping and correlation of stratigraphic units and provided information about environment of deposition and paleogeographic conditions. The general geologic map of Bristol Bay and the area around it was compiled by D. C. Case, 1957, and Martin, 1961, 1962, and Martin, 1964, 1965. The remainder of the area was poorly known and had few recent investigations. We have added 255 collections of marine megafossils, many from megafossil localities, and made a detailed stratigraphic correlation to the various rock units. Checklists of fossils (table 1 through 9, sheet 2) and stratigraphic sections (sheet 3) are included with this locality map.

The oldest exposed rocks are an unmetamorphosed Permian limestone present only on an small reef near Cape Khabarov. The thick-bedded gray limestone is about 45 m thick and contains poorly preserved megafossils and microfossils of late Early to early Late Permian age (table 1). The limestone has no exposed contacts with older or younger rocks.

Late Triassic (Berian) limestone with interbedded basalt and volcanic rubble (flow) is exposed at the mouth of Paine Bay and along the coast between Paine Bay and Alitash Bay. The limestone is mainly light gray to light tan and is bedded locally in a disconformity. Fossils are sparse throughout (table 2), but locally are very abundant on reef structures. The unmetamorphosed unit is about 70 m thick. The contact with the overlying Talofol Formation is conformable.

The name Talofol Formation is here applied to the previously unnamed Alitash limestone. The Talofol Formation is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

The Shelikof Formation is characterized by rapid facies changes that occur both transverse and parallel to the trend of outcrop area. The Shelikof Formation is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

The megafossil to shallow-water shelf deposits of the Naknek Formation also exhibit rapid lateral facies change. The sequence of strata about 1,000 to 2,000 m thick can be divided roughly into three parts: a lower part consisting of coarse-grained sandstone and siltstone, a middle part consisting of fine-grained sandstone and siltstone, and an upper part consisting of fine-grained sandstone and siltstone. The lower part is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

Fossil Zone	Age
Buchia blanfordiana	Upper Tithonian
Buchia blanfordiana	Upper Kimmeridgian
Buchia blanfordiana	Lower Kimmeridgian
Buchia blanfordiana	Turonian

A number of *Buchia blanfordiana* specimens were collected from the upper part of the Shelikof Formation, but not from the upper part of the Naknek Formation. A few ammonites and other pelagic fossils are found in the Naknek Formation, but are not age diagnostic.

Deposition was continuous from the Naknek Formation into the overlying Shelikof Formation. The Shelikof Formation is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

Strata of Late Cretaceous age attain a maximum thickness of about 100 m and consist mainly of siltstone and shale with minor amounts of sandstone. The megafossil to shallow-water shelf deposits of the Naknek Formation also exhibit rapid lateral facies change. The sequence of strata about 1,000 to 2,000 m thick can be divided roughly into three parts: a lower part consisting of coarse-grained sandstone and siltstone, a middle part consisting of fine-grained sandstone and siltstone, and an upper part consisting of fine-grained sandstone and siltstone. The lower part is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

The Shelikof Formation is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

The megafossil to shallow-water shelf deposits of the Naknek Formation also exhibit rapid lateral facies change. The sequence of strata about 1,000 to 2,000 m thick can be divided roughly into three parts: a lower part consisting of coarse-grained sandstone and siltstone, a middle part consisting of fine-grained sandstone and siltstone, and an upper part consisting of fine-grained sandstone and siltstone. The lower part is a massive, light-colored, silty limestone and is usually fine grained. The rock contains a diverse and abundant megafossil fauna, including corals, bryozoans, and graptolites. Many of the genera contain several species. The age of these rocks is based on stratigraphic correlation to the Berian limestone of the Yukon-Tanana Terrane. There are no readily apparent breaks in the section that might suggest both are missing, so the absence of bryozoan fossils may be an artifact of collecting.

Intrusive rocks occur in numerous localities in the mapped area and range in size from small dikes and sills to large batholiths. The quartz diorite batholith near Cape Khabarov is the largest and has been dated as 4.6 ± 0.2 to 3.2 m.y. (F. H. Wilson, written commun., 1983). The oldest intrusive body is a granodiorite, part of the Alaska Peninsula batholiths. The batholiths were brought to the surface along the Bristol Bay fault and are exposed only on one small island southeast of Cape Khabarov. An age of 172 to 176 m.y. was determined for these (Reed and Lamberson, 1982).

REFERENCES CITED

Brookway, Tom, chairman, 1973, Bristol Bay Stratigraphic Committee: Bristol Bay region, central Alaska, Miscellaneous Field Studies, U.S. Geological Survey Bulletin 1382-A, 100 p.

Case, D. C., 1957, The Gulf of Alaska district, Alaska, U.S. Geological Survey Bulletin 738-A, p. 37-116.

Hansen, R. W., 1967, Middle Permian limestone on Pacific side of Alaska Peninsula: American Association of Petroleum Geologists Bulletin, v. 41, p. 2078-2079.

Isley, R. W., 1962, Cretaceous (Jurassic) ammonites from United States and Alaska: U.S. Geological Survey Bulletin 1009-B, 10 p.

Isley, R. W., 1963, Jurassic (Santonian) and Early Cretaceous ammonites from Alaska and Yukon: U.S. Geological Survey Bulletin 1010-A, 10 p.

Isley, R. W., 1964, Stratigraphic distribution and zonation of Jurassic (Cretaceous) ammonites from Alaska: U.S. Geological Survey Professional Paper 886, 78 p.

Isley, R. W., 1965, Middle Permian limestone from southern Alaska: U.S. Geological Survey Professional Paper 1091, 40 p.

Isley, R. W., 1967, Early Jurassic ammonites from southern Alaska: U.S. Geological Survey Bulletin 770, 25 p.

Isley, R. W., and Detterman, Robert L., 1973, Jurassic paleogeography of Alaska: U.S. Geological Survey Professional Paper 801, 34 p.

Isley, R. W., 1974, Some Lower Miocene gastropods from the Paine Bay area, Alaska: American Association of Petroleum Geologists Bulletin, v. 61, p. 607-611.

Keller, R. J., and Bellar, W. R., 1959, Geology of the Mount Katmai area: U.S. Geological Survey Bulletin 1009-A, 10 p.

Reed, G. L., and Lamberson, R. H., 1982, Age and chemistry of Mesozoic and Tertiary plutonic rocks in southeastern Alaska: U.S. Geological Survey Bulletin 785, p. 63-88.

Saiki, M., and Baker, A. R., 1928, The geology and oil settlements of the Cold Bay district: U.S. Geological Survey Bulletin 785, p. 63-88.

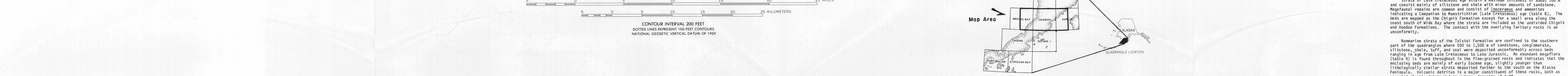
Saiki, M., and Baker, A. R., 1928, The geology and oil settlements of the Cold Bay district: U.S. Geological Survey Bulletin 785, p. 63-88.

Westermann, G. T., 1962, Map and section of the stratigraphic formation at Wide Bay, Alaska Peninsula—Part 1, Lower Paleozoic (Algonkian): Miscellaneous Field Studies, U.S. Geological Survey Bulletin 1382-B, v. 4, p. 126, p. 259.

1969, The ammonite fauna of the Klappan Formation at Wide Bay, Alaska Peninsula: U.S. Geological Survey Bulletin 1382-B, v. 4, p. 126, p. 259.

Wilson, F. H., 1980, Map and section of preliminary results of 4-6 year studies in the Ugashik quadrangle, Alaska Peninsula: U.S. Geological Survey Open-File Report 80-140, 1 sheet.

Wilson, F. H., Gunn, W. C., Heron, P. L., 1981, Map and table showing geochronology and radiometric geochronology, Cretaceous and Tertiary 13 and 14 quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1539-B, 3 sheets.



STRATIGRAPHIC AND SEDIMENTARY ROCKS	VOLCANIC ROCKS	VOLCANIC AND INTRUSIVE ROCKS	INTRUSIVE ROCKS	DESCRIPTION OF MAP UNITS
Qa Quaternary Unconformity				Unconformity
Tar Tertiary Unconformity				Unconformity
Ti Tertiary Unconformity				Unconformity
Tc Tertiary Unconformity				Unconformity
Tu Tertiary Unconformity				Unconformity
Tv Tertiary Unconformity				Unconformity
Tw Tertiary Unconformity				Unconformity
Tx Tertiary Unconformity				Unconformity
Ty Tertiary Unconformity				Unconformity
Tz Tertiary Unconformity				Unconformity
Taa Tertiary Unconformity				Unconformity
Tab Tertiary Unconformity				Unconformity
Tac Tertiary Unconformity				Unconformity
Tad Tertiary Unconformity				Unconformity
Tae Tertiary Unconformity				Unconformity
Taf Tertiary Unconformity				Unconformity
Tag Tertiary Unconformity				Unconformity
Tah Tertiary Unconformity				Unconformity
Tai Tertiary Unconformity				Unconformity
Taj Tertiary Unconformity				Unconformity
Tak Tertiary Unconformity				Unconformity
Tal Tertiary Unconformity				Unconformity
Tam Tertiary Unconformity				Unconformity
Tan Tertiary Unconformity				Unconformity
Tao Tertiary Unconformity				Unconformity
Tap Tertiary Unconformity				Unconformity
Taq Tertiary Unconformity				Unconformity
Tar Tertiary Unconformity				Unconformity
Tas Tertiary Unconformity				Unconformity
Tat Tertiary Unconformity				Unconformity
Tau Tertiary Unconformity				Unconformity
Tav Tertiary Unconformity				Unconformity
Taw Tertiary Unconformity				Unconformity
Tax Tertiary Unconformity				Unconformity
Tay Tertiary Unconformity				Unconformity
Taz Tertiary Unconformity				Unconformity
Tba Tertiary Unconformity				Unconformity
Tbb Tertiary Unconformity				Unconformity
Tbc Tertiary Unconformity				Unconformity
Tbd Tertiary Unconformity				Unconformity
Tbe Tertiary Unconformity				Unconformity
Tbf Tertiary Unconformity				Unconformity
Tbg Tertiary Unconformity				Unconformity
Tbh Tertiary Unconformity				Unconformity
Tbi Tertiary Unconformity				Unconformity
Tbj Tertiary Unconformity				Unconformity
Tbk Tertiary Unconformity				Unconformity
Tbl Tertiary Unconformity				Unconformity
Tbm Tertiary Unconformity				Unconformity
Tbn Tertiary Unconformity				Unconformity
Tbo Tertiary Unconformity				Unconformity
Tbp Tertiary Unconformity				Unconformity
Tbq Tertiary Unconformity				Unconformity
Tbr Tertiary Unconformity				Unconformity
Tbs Tertiary Unconformity				Unconformity
Tbt Tertiary Unconformity				Unconformity
Tbu Tertiary Unconformity				Unconformity
Tbv Tertiary Unconformity				Unconformity
Tbw Tertiary Unconformity				Unconformity
Tbx Tertiary Unconformity				Unconformity
Tby Tertiary Unconformity				Unconformity
Tbz Tertiary Unconformity				Unconformity
Tca Tertiary Unconformity				Unconformity
Tcb Tertiary Unconformity				Unconformity
Tcc Tertiary Unconformity				Unconformity
Tcd Tertiary Unconformity				Unconformity
Tce Tertiary Unconformity				Unconformity
Tcf Tertiary Unconformity				Unconformity
Tcg Tertiary Unconformity				Unconformity
Tch Tertiary Unconformity				Unconformity
Tci Tertiary Unconformity				Unconformity
Tcj Tertiary Unconformity				Unconformity
Tck Tertiary Unconformity				Unconformity
Tcl Tertiary Unconformity				Unconformity
Tcm Tertiary Unconformity				Unconformity
Tcn Tertiary Unconformity				Unconformity
Tco Tertiary Unconformity				Unconformity
Tcp Tertiary Unconformity				Unconformity
Tcq Tertiary Unconformity				Unconformity
Tcr Tertiary Unconformity				Unconformity
Tcs Tertiary Unconformity				Unconformity
Tct Tertiary Unconformity				Unconformity
Tcu Tertiary Unconformity				Unconformity
Tcv Tertiary Unconformity				Unconformity
Tcw Tertiary Unconformity				Unconformity
Tcx Tertiary Unconformity				Unconformity
Tcy Tertiary Unconformity				Unconformity
Tcz Tertiary Unconformity				Unconformity
Tda Tertiary Unconformity				Unconformity
Tdb Tertiary Unconformity				Unconformity
Tdc Tertiary Unconformity				Unconformity
Tdd Tertiary Unconformity				Unconformity
Tde Tertiary Unconformity				Unconformity
Tdf Tertiary Unconformity				Unconformity
Tdg Tertiary Unconformity				Unconformity
Tdh Tertiary Unconformity				Unconformity
Tdi Tertiary Unconformity				Unconformity
Tdj Tertiary Unconformity				Unconformity
Tdk Tertiary Unconformity				Unconformity
Tdl Tertiary Unconformity				Unconformity
Tdm Tertiary Unconformity				Unconformity
Tdn Tertiary Unconformity				Unconformity
Tdo Tertiary Unconformity				Unconformity
Tdp Tertiary Unconformity				Unconformity
Tdq Tertiary Unconformity				Unconformity
Tdr Tertiary Unconformity				Unconformity
Tds Tertiary Unconformity				Unconformity
Tdt Tertiary Unconformity				Unconformity
Tdu Tertiary Unconformity				Unconformity
Tdv Tertiary Unconformity				Unconformity
Tdw Tertiary Unconformity				Unconformity
Tdx Tertiary Unconformity				Unconformity
Tdy Tertiary Unconformity				Unconformity
Tdz Tertiary Unconformity				Unconformity
Tea Tertiary Unconformity				Unconformity
Teb Tertiary Unconformity				Unconformity
Tec Tertiary Unconformity				Unconformity
Ted Tertiary Unconformity				Unconformity
Tee Tertiary Unconformity				Unconformity
Tef Tertiary Unconformity				Unconformity
Teg Tertiary Unconformity				Unconformity
Teh Tertiary Unconformity				Unconformity
Tei Tertiary Unconformity				Unconformity
Tej Tertiary Unconformity				Unconformity
Tek Tertiary Unconformity				Unconformity
Tel Tertiary Unconformity				Unconformity
Tem Tertiary Unconformity				Unconformity
Ten Tertiary Unconformity				Unconformity
Teo Tertiary Unconformity				Unconformity
Teq Tertiary Unconformity				Unconformity
Ter Tertiary Unconformity				Unconformity
Tes Tertiary Unconformity				Unconformity
Tet Tertiary Unconformity				Unconformity
Teu Tertiary Unconformity				Unconformity
TeV Tertiary Unconformity				Unconformity
TeW Tertiary Unconformity				Unconformity
Tex Tertiary Unconformity				Unconformity
TeY Tertiary Unconformity				Unconformity
TeZ Tertiary Unconformity				Unconformity
Tfa Tertiary Unconformity				Unconformity
Tfb Tertiary Unconformity				Unconformity
Tfc Tertiary Unconformity				Unconformity
Tfd Tertiary Unconformity				Unconformity
Tfe Tertiary Unconformity				Unconformity
Tff Tertiary Unconformity				Unconformity
Tfg Tertiary Unconformity				Unconformity
Tfh Tertiary Unconformity				Unconformity
Tfi Tertiary Unconformity				Unconformity
Tfj Tertiary Unconformity				Unconformity
Tfk Tertiary Unconformity				Unconformity
Tfl Tertiary Unconformity				Unconformity
Tfm Tertiary Unconformity				Unconformity
Tfn Tertiary Unconformity				Unconformity
Tfo Tertiary Unconformity				Unconformity
Tfp Tertiary Unconformity				Unconformity
Tfq Tertiary Unconformity				Unconformity
Tfr Tertiary Unconformity				Unconformity
Tfs Tertiary Unconformity				Unconformity
Tft Tertiary Unconformity				Unconformity
Tfu Tertiary Unconformity				Unconformity
Tfv Tertiary Unconformity				Unconformity
Tfw Tertiary Unconformity				Unconformity
Tfx Tertiary Unconformity				Unconformity
Tfy Tertiary Unconformity				Unconformity
Tfz Tertiary Unconformity				Unconformity
Tga Tertiary Unconformity				Unconformity
Tgb Tertiary Unconformity				Unconformity
Tgc Tertiary Unconformity				Unconformity
Tgd Tertiary Unconformity				