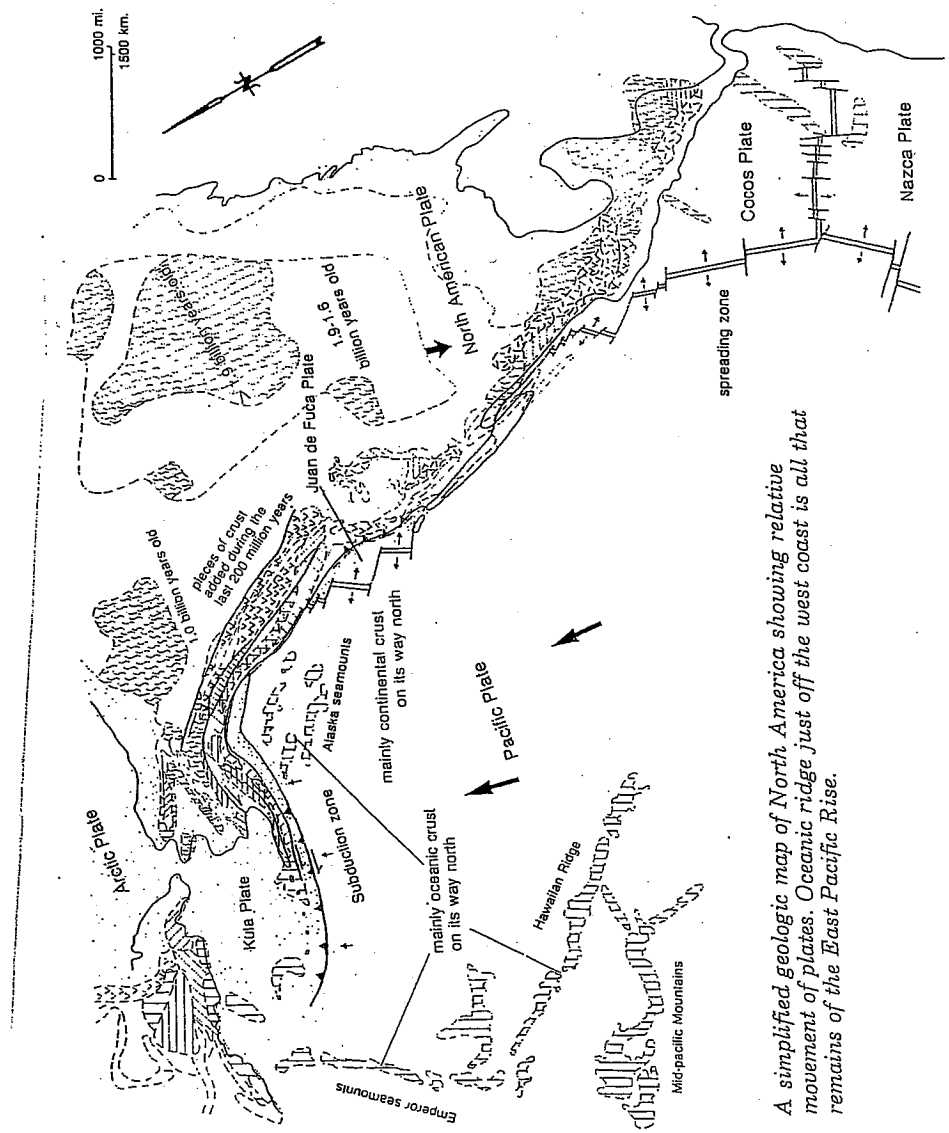
INTRODUCTION

The rocks that make up Alaska began their journey there, like most of the state's residents, from points far away. Large pieces of the earth's crust, perhaps as many as fifty, drifted into place and became geologically glued together to form the state of Alaska. The state has grown like a snowman by adding material to its edges. The pieces have been added in waves, the last one beginning about 200 million years ago and continuing through to the present.

The entire Pacific Coast of the North American continent, from Baja California to the end of the Aleutian Chain in western Alaska, has been transplanted and grafted on piecemeal. Alaska is at the northern receiving end of a conveyor belt of ready-made blocks of crust, some of which have traveled thousands of miles across the Pacific basin. These blocks have been as large as several thousand square miles. In some cases they have survived their journey with relatively little wear and tear.

For a long time an important section of the conveyor belt was the Kula plate, a now vanished oceanic plate that was pushed northward by the Pacific Plate. About 40 million years ago, the Kula plate slid down an oceanic trench; it was subducted beneath North America. Today the sole surviving piece of the Kula plate lies beneath the shallow water of the Bering Sea.

Some of Alaska's blocks began as ocean crust formed by the eruption of undersea volcanoes and vents along giant sea-floor rifts like those near the Galapagos Islands today. Other blocks



A simplified geologic map of North America showing relative movement of plates. Oceanic ridge just off the west coast is all that remains of the East Pacific Rise.

were created as chains of volcanic islands formed in areas where moving slabs of denser oceanic crust sank into the earth's interior and pushed beneath masses of continental crust. Still other blocks formed by accumulation of sediments eroded from the continents.

As the blocks moved across the Pacific Ocean and made contact with the North America continent, they were often sliced up along faults into narrow strips parallel to the continental margin. The Yakutat block, now arriving in Alaska's southern coast, is sliding along the Queen Charlotte-Fairweather fault system, sandwiched between the Pacific and North American plates.

The continuing rise of the St. Elias Mountains, earthquakes along the coast, and rerouting of many rivers in the Yukon, are just some of the effects of this newly arrived block merging into southern Alaska.

Plate Tectonics

The earth's land masses ride on large pieces of lithosphere, the earth's crust and more rigid part of the upper mantle, that are in continuous motion relative to one another. Beneath the lithosphere, heat causes convection currents to flow slowly in the plastic deeper part of the mantle. At places where convection currents rise through the mantle, rift zones form on the ocean floor; magma wells up to fill the sea floor fractures and erupts on the sea floor forming new oceanic crust. Crustal plates move along on the convection currents. At the edge of ocean basins, plates collide with the thick, less dense crust of adjacent continents. There the oceanic crust and upper mantle sink beneath the more buoyant continental crust along deep-sea trenches. The size of the earth is not changing so an equal amount of oceanic crust must be destroyed for all that is made.

The southern coast of Alaska is an active zone of plate collision, an area where the continent is growing by the addition of seaboard terranes. Here, oceanic crustal rocks are being forced beneath the continent. Deep-sea sediments and some volcanic rocks are too buoyant to be dragged down a trench so the less dense material is scraped off onto the continental margin. Many of the rocks along Alaska's southern margin were formed as such trench wall scrapings. Geologists call them melanges.

The subducted material is heated up and partially melted as it moves beneath the continent, generating magma that rises and erupts to form volcanoes at the surface.

The Making of Alaska

Unravelling Alaska's complex and fragmented geologic history would have baffled Sherlock Holmes. Deciphering Alaska's geologic mysteries has taken many summers of geologic field work and the job is far from over. Progress has been slowed by the ruggedness and remoteness of the land. The geologic maps of Alaska are now in their early stages compared to those available in the lower 48 states. Important geologic clues in Alaska are covered by ice caps, by great expanses of tundra or alder bushes. Large brown bears who dislike disturbances caused by rock hammering, outboard motors, or helicopters, guard some of the clues.

Fossil Evidence of Terrane Movement

The fossil record contains important evidence of earth history. Marine organisms now preserved as fossils in the far north spent their lives in tropical waters. The present distribution of these fossils provides information that enables geologists to reconstruct plate movements. These animals lived in the Tethys Sea, which during Permian time separated Europe and Asia to the north from Africa, India, Tibet, and Australia to the south. The presence of 'Tethyan' fossils in Alaska and British Columbia suggests that the terranes on which they are riding moved across the Pacific Ocean basin from the original Tethys Sea.

Fossil Magnetic Fields

For unknown reasons the earth's magnetic field sometimes reverses itself so that the north magnetic pole becomes the south magnetic pole. The reversals are preserved in the rock record in the orientation of magnetite crystals that align themselves as they cool in volcanic lavas, or in some iron-bearing sedimentary rocks. Both the direction of magnetic north and the inclination of the magnetic field at the latitude of formation are preserved by this iron mineral. This information is used to reconstruct the latitude at which the rock formed and how the rock mass has rotated since it formed. Terranes such as Wrangellia originated either 15 degrees north or south of the equator, either way a considerable distance from modern Alaska latitudes of more than 54 degrees north.