A Transect Across Alaska, From Pacific To Arctic Margins

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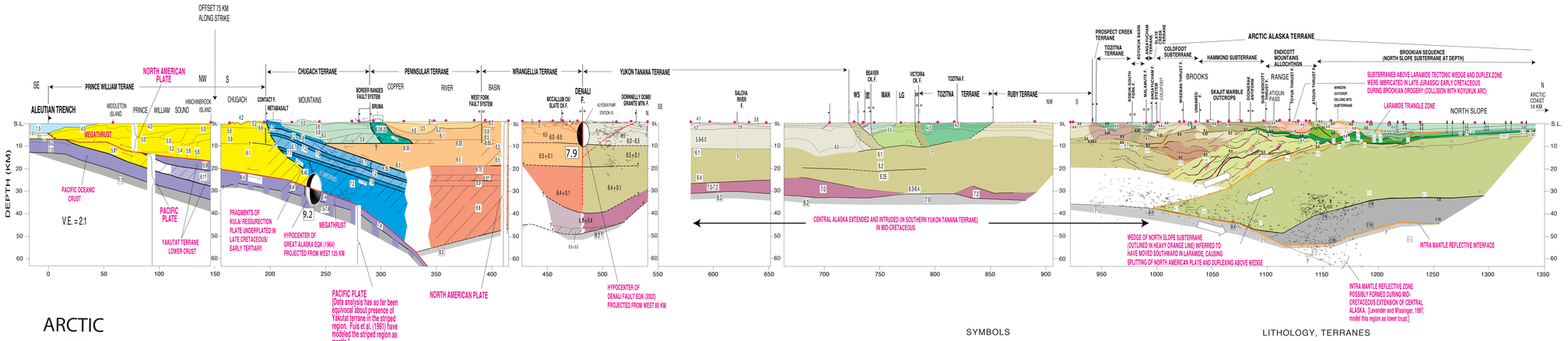
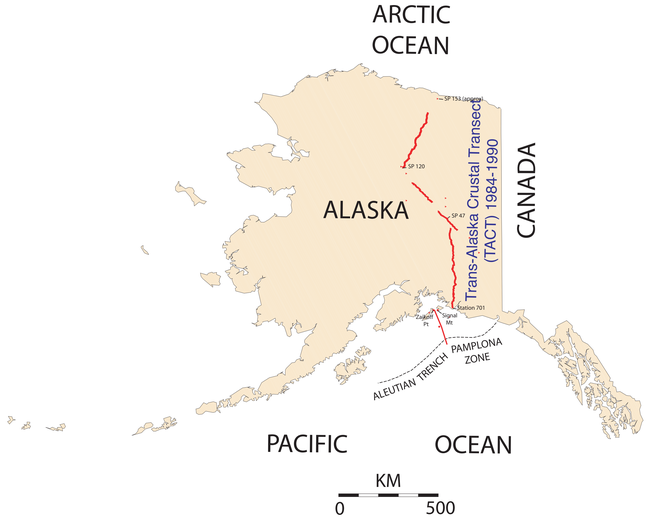




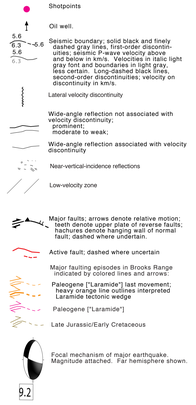
ABSTRACT

During the period 1984 to 1990, the U.S. Geological Survey, University collaborators, and the Alaska Division of Geological and Geophysical Surveys investigated the crust of Alaska along a ~1500-km-long, north-south corridor. The project, known as the Trans-Alaska Crustal Transect (TACT), extended from the trench in the Gulf of Alaska to the Arctic coast. The data collected included refraction/wide-angle reflection, vertical-incidence reflection, geologic, gravity, magnetic, magnetotelluric, earthquake, and petrophysical data. In most places onshore, the seismic data were collected along or near the Trans-Alaska Oil Pipeline. The transect crossed oceanic, oceanic-arc and platform, and continental-marginal terranes that have been variously subducted, subcreted, accreted, rotated, imbricated by thrust faults, translated by strike-slip faults, and intruded by numerous magmatic arcs. We use the data collectively to present an interpretation of the structure and tectonic history of Alaska. Currently in the Gulf of Alaska, the Pacific plate and the overlying Yakutat terrane are subducting beneath and colliding with the North American plate. (The Yakutat terrane includes fragments of an accretionary prism and of the Pacific plate.) Subduction is resisted by the buoyancy of this doubly thick oceanic crust. Currently on the Arctic margin of northeastern Alaska, there is compression that may be related to the ongoing subduction/collision of the Pacific plate/Yakutat terrane (PAC/YAK) in the south.

The most spectacular structures and the deepest Moho along the transect are located near the Pacific and Arctic margins. Near the Pacific margin, the Chugach Mountains are being uplifted by the subduction/collision of the PAC/YAK and are underlain by a stack of subcreted oceanic layers similar to the PAC/YAK. We interpret this stack as remnants of the extinct Kula (or Resurrection) plate that was converging rapidly on North America in the latest Cretaceous and early Cenozoic. Continental Moho just landward of this subcreted stack is more than 55 km deep, in an area of low-lying topography. Near the Arctic margin, the Brooks Range and southern part of the North Slope are underlain by striking duplex structures that extend ever deeper into the crust from north to south. We interpret these duplexes to overlie a crustal-scale wedge consisting of continental crust of the North Slope passive margin and an attached fragment of mantle that has moved southward with respect to the North American plate. Moho has been depressed to nearly 50-km depth beneath the crest of the Brooks Range. The tectonic history leading to the current structure of northeastern Alaska is complex, with several compressional episodes and at least one extensional episode occurring between late Jurassic/Early Cretaceous and the present.

Central Alaska consists of continental-marginal terranes and at least one oceanic arc that collided with these terranes in the Late Jurassic/Early Cretaceous and was partially obducted. Some of these terranes were oroclinally folded in the Early Cretaceous, and many were extended and intruded in the mid-Cretaceous. Offset along major strike-slip faults (Tintina and Denali faults) followed. Moho is everywhere between 30 and 35 km deep in central Alaska.

SYMBOLS



LITHOLOGY, TERRANES

BASIC MATERIAL FOR THIS TRANSECT WAS TAKEN FROM:

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